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AERIAL AGE
WEEKLY

VOL. 14, No. 8 OCTOBER 31, 1921 10 CENTS A COPY

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HOUSTON, TEXAS

Airscape of Grant's Tomb, New York City, Photographed for the Fairchild Aerial Camera Corp., by W. L. Hamilton

Standardization in Aeroplane Design

UBLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY

AERONAUTIC BOOKS

Test Methods for Mechanical Fabrics

By George B. Haven, Associate Professor of Mechanical Engineering, Massachusetts Institute of Technology. Contents.—Aerodynamics. Wind Tunnels. Wings. Resistance. Estimation of Performance. Stress Analysis (by Prof. Howard B. Luther, of Massachusetts Institute of Technology). Weight Estimation. Airscrews. Motors. Materials of Construction. [Wiley.]

Principles of Airplane Design

By George Marshall Denkinger, Research Aeronautical Engineer, Air Service, U. S. A., and Clarence Dean Hanscom, formerly Research Aeronautical Engineer, Air Service, U. S. A. (In preparation. Ready Spring, 1921.) Vol. I. Theoretical and Experimental Aerodynamics. Contents.—Aerodynamics. Wind Tunnels. Wings. Resistance. Vol. II. Applied Aerodynamics. Contents.—Estimation of Performance. Stress Analysis. Weight Estimation. Air Screws. Motors. Materials of Construction. [Wiley.]

Aeronautics—A Class Text

By Edwin Bidwell Wilson, Ph.D., Professor of Mathematical Physics in the Massachusetts Institute of Technology. 265 pages. 6 by 9. 31 figures. Cloth. Postpaid $4.25.

Covers those portions of dynamics, both rigid and fluid, which are fundamental in aeronautical engineering. It presupposes some knowledge of calculus. The book will prove stimulating to other than technical students of aeronautical engineering. Contents.—Introduction. Mathematical Preliminaries. The Pressure On a Plane. The Skeleton Airplane. Rigid Mechanics. Motion in a Resisting Medium. Harmonic Motion. Motion in Two Dimensions. Motion in Three Dimensions. Stability of the Airplane. Fluid Mechanics. Motion Along a Tube. Planar Motion. Theory of Dimensions. Forces On An Airplane. Stream Function, Velocity Potential. Motion of a Body in a Liquid. Motion in Three Dimensions. Index. [Wiley.]

The Dynamics of the Airplane

By K. P. Williams, Ph.D., Associate Professor of Mathematics, Indiana University. (No. 21 of Mathematical Monographs, Edited by Mansfield Merriman and Robert S. Woodward.) 138 pages. 6 by 9. 50 figures. Cloth. Postpaid $2.75.

An introduction to the dynamical problems connected with the motion of an aeroplane, for the student of mathematics or physics. While not written for the person interested mainly with design and construction, most of the questions treated have some interest for anyone who is familiar with the entire field of aeronautics. The development of the French writers is followed more closely than that of the English and American, the author believing that it is worth while to make a treatment of this general sort accessible to American students of mathematics. Contents.—The Plane and Cambered Surface. Straight Horizontal Flight. Descent and Ascent. Circular Flight: 1. Horizontal Turns. 2. Circular Descent. The Propeller. Performance: 1. Ceiling. 2. Radius of Action. Stability and Controllability: Longitudinal Stability. Stability in Rolling. Lateral Stability. [Wiley.]

Learning to Fly in the U. S. Army

By E. N. Fales. 180 pages. 5 x 7. Illustrated. Postpaid $1.75.

In this book are set forth the main principles of flying which the aviator must know in order properly to understand his aeroplane, to keep it trued up, and to operate it in cross country flight as well as at the flying field. The material presented is all standard information, previously available to students only in fragmentary form, but not up to this time collected and arranged in logical order for study and quick reference. Contents.—I. History of Aviation. II. Types of Military Airplanes and Uses. III. Principles of Flight. IV. Flying the Airplane. V. Cross-Country Flying. VI. The Rigging of Airplanes—Nomenclature. VII. Materials of Construction. VIII. Erecting Airplanes. IX. Truing Up the Fuselage. X. Handling of Airplanes in the Field and At the Bases Previous to and After Flights. XI. Inspection of Airplanes. [McGraw.]

Aircraft Mechanics Handbook

By Fred H. Colvin, Editor of American Machinist. 402 pages. 5 by 7. 193 illustrations. Postpaid $4.25. New Edition.

A book specifically for the aircraft mechanic. During the war it was extensively used as a textbook in the U. S. Navy Training Stations, the Army Flying Fields and Schools of Military Aeronautics. It covers briefly the principles of construction, and gives in detail methods of erecting and adjusting the plane. The book is especially complete on the care and repair of motors. Descriptions of the various types of military aeroplanes and engines are given. The photographs and cuts show the principles and practice of adjustment and operation. [McGraw.]

Airplane Design and Construction

By Ottorino Pomilio. 403 pages. 6 by 9. Illustrated. Postpaid $5.25.

This was the first book to be published in this country which presents in detail the application of aerodynamic research to practical aeroplane design and construction. Although the feat of flying in a heavier than air machine was first accomplished in America, the major part of experimental work in aerodynamics has been conducted in Europe. The Pomilios of Italy have had an important part in this experimental work. The data presented in this book should enable designers and manufacturers to save both time and expense. The arrangement, presentation of subject matter, and explanation of the derivation of working formulae together with the assumptions upon which they are based and consequently their limitations, are such that the book should be indispensable to the practical designer and to the student. [McGraw.]

Radio Engineering Principles

By Henri Lauer, formerly Lieutenant, Signal Corps, U. S. A., Assistant in the Preparation of Training Literature on Radio Theory and Equipment, and Harry L. Brown, formerly Captain, Signal Corps, U. S. A., in charge of the Preparation of the Technical Training Literature used in the Signal Service. 304 pages. 6 by 9. 250 illustrations. Postpaid $3.75.

This is the first book to bring the science of radio up to date—to include the wonderful developments made during the war. In no other book published in this country is there such complete information on vacuum tubes. About one-half of Lauer and Brown's "Radio Engineering Principles" is devoted to the discussion of the three-electrode vacuum tube, taking up its use as detector, amplifier, oscillator and modulator. The book covers thoroughly the operation and characteristics of two- and three-electrode vacuum tubes, the practical applications of the tubes, the generation and control of electron flow, and the conditions which must obtain to cause a tube to operate in any of its functions. Aeroplane and submarine radio theory is discussed in detail. Other special applications of the vacuum tube are also treated. Lauer and Brown's "Radio Engineering Principles" is the authoritative modern textbook on the subject. [McGraw.]

Standard Handbook for Electrical Engineers

Frank F. Fowle, Editor-in-Chief, assisted by over sixty leading specialists. 25 thumb-indexed sections. 2000 pages. 4 by 7. Flexible. Illustrated. Postpaid $7.40 net.

The "Standard" is the most widely-used electrical book in the world. It is quoted everywhere as the final authority on electrical engineering. It has been endorsed by the leading electrical journals here and abroad. It is an encyclopedia of electrical engineering. Its twenty-five thoroughly indexed sections cover every phase of the subject. The book is the work of more than sixty of the world's foremost electrical engineers. It has been called a triumph of engineering cooperation because of its completeness, its reliability, and its get-at-ableness. [McGraw.]

The Aeroplane Speaks

By H. Barber. A. F. Ae. S. (Captain, Royal Flying Corps). Postpaid $3.25.

Captain Barber, whose experience in designing, building and flying aeroplanes extends over a period of eight years, has written this book to be of assistance to the pilot and his aids. Lucid and well illustrated chapters on flight, stability and control, rigging, propellers and maintenance are followed by a glossary of aeronautical terms and thirty-five plates illustrating the various types of aeroplanes and their development from the first practical flying machine. An introduction presents, in the form of conversations between the various parts of the aeroplane, a simple explanation of the principles of flight, written, says the author, "to help the ordinary man to understand the aeroplane and the joys and troubles of its pilot." [McBride.]

Aeroplane Design

By F. S. Barnwell. With a Simple Explanation of Inherent Stability—By W. H. Sayers. With diagrams. Postpaid $1.10.

Mr. Barnwell, who is well known as a highly successful designer, holds a commission in the Royal Flying Corps. The section of this book written by him formed a treatise read before the Engineering Society of Glasgow University. Mr. W. H. Sayers in the second part of the volume elucidates a problem that has been the occasion of much discussion among mathematicians—that of inherent stability. Both sections are fully illustrated by diagrams. This book has been adopted by the U. S. Government as a text book for the instruction of aviators. [McBride.]

Aerobatics

By Horatio Barber, A. F. Ae. S. With 29 half-tone plates showing the principal evolutions. Postpaid $3.50.

This book by Captain Barber, whose earlier work, "The Aeroplane Speaks", is recognized as the standard textbook on ground work and the theory of flight, is an explanation in simple form, and for the benefit of the student, of the general rules governing elementary and advanced flying. Part I, which is headed "Elementary Flying", is an explanation of the essential elements of flight instruction from the moment the student enters the machine until he becomes a finished pilot. The mechanical control of the machine, straight flying, turns of all kinds, stalling, diving, gliding, slide-slips, and various ways of landing, flying through clouds, "taxying" and the first solo flight are described and analyzed fully and in non-technical language, each subject being taken up in progressive order. Part II explains the more advanced evolutions such as looping, spinning, the half roll, the complete roll, the Immelman turn, the falling leaf, the cart wheel, etc. The book contains a progressive syllabus of instruction, a glossary of technical terms and numerous advisory hints. [McBride.]

Flying Guide and Log Book

By Bruce Eytinge. With a Foreword by H. M. Hickam, Major, Air Service. 1921 edition, enlarged and revised to date. 150 pages. 4¾ by 7¼. 38 illustrations, including many photographs of landing fields, and a 24-page Pilot's Log Book for Machine, Motor and Flying. Cloth. Postpaid $2.75.

This book contains valuable information for the aviator, and also, for all those who are interested in, and helping to develop, commercial aviation. Contents.—Calendar. Identification. Frontispiece. Foreword. Past and Present (Poem). Introduction. Don'ts. Helpful Hints. Landing Field Report (Questionnaire). Airdromes—Landing Fields. War Department Orders: Specifications for Municipal Landing Fields. General Flying Rules to Be Observed At All U. S. Flying Fields. Cross-Country Flight Regulations. Rules of the Air. Flying Certificates for Pilots. Trouble Shooting in Airplane Engines. America's Aviation Facilities—Landing Fields (Alphabetically Listed Under Each State). Trans-Continental Aerial Mail Route. Air Routes (Round the Rim Flight). Pilot's Log Book for Machine, Motor and Flying. [Wiley.]

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October 31, 1921

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Standardization in Aeroplane Design

THE idea of standardization is usually associated with nuts, bolts, clevises, turnbuckles and other small parts. It is extremely important that all of these parts should be standardized—in fact, there could be no aeroplane production if this were not the case. However, most of the work of this character has been completed satisfactorily, though it is being extended to embrace more and more kinds of small parts, such as connections, and valves in fuel, oil and water systems.

The general principle of standardization can also be effectively applied to the semi-raw materials entering into aeroplane construction, such as steel and duralumin sheet, tubing, and structural shapes, and to plywood. In the case of tubing, for instance, manufacturers put out several hundred sizes which can be obtained in two or three grades of steel. To attempt to carry such assortment in stock is impossible. It is a great advantage to have both military and commercial aeroplanes designed from a comparatively limited list of tubing which could be kept in stock by even small repair depots. In production, matters are considerably simplified if the number of sizes of material handled is small.

The designer is not handicapped in structural work if he has only some sixty sizes of tubing, including both carbon and alloy steel, to choose from. Such a carefully selected list has been prepared and used with much success at McCook Field. In a similar manner much shorter lists of oval and streamline tubing and of U, channel and angle sections can be made up. The designer instead of using any odd size would select a suitable section from these lists. Owing to the newness of metal construction in aeroplane design, the number of such sections available is small. New dies or rolls are required to manufacture sections not on hand, which makes the use of many different sizes prohibitive because of cost.

Plywood is another material which designers in the past have been at no pains to standardize as to total thickness, ply thickness, and combination of plies or woods used. It has been impossible for manufacturers to keep a sufficient variety of plywood in stock to supply the varied calls of designers. To get the best results from plywood requires careful design. In general, it is much better to select a plywood from such a table as has been prepared by McCook Field than to design it. In this table the entire range in thicknesses from 1/16 to 1 in. has been covered by the use of only five ply thicknesses in various combinations, chosen to give the proper ratio of core to total thickness.

Three general principles should be borne in mind in all standardization work. First, what is selected as a standard must be commercially available. Second, the lists of sizes should be just as small as it can be made without handicapping the designers. Third, those sizes and shapes which are standardized should be the most efficient. B.C.B.

[The tables and lists mentioned will be published in AERIAL AGE in the near future.]

New Theory of the Slotted Wing

IN a paper recently read before the Society for Aeronautical Science at Munich, Dr. Betz dealt with a certain development in sustaining planes or aircraft wings due to Lachmann in Germany and Handley Page in England. The object is to increase the lift by providing slots in the wing parallel to the leading edge. If these are to be effective they must extend without interruption across the entire width of the wing. This arrangement may also be regarded as an extra plane of small depth placed in front of the main wing at its leading edge so that there is only a very small space left between the two. The maximum lift of the plane is thereby increased by 80 per cent or more. There are different explanations of this phenomenon. One is that the small plane located in front of the main plane is located in an air stream whose conditions of flow are determined by the main wing. It follows that at the leading edge of the main wing the air speed materially exceeds the speed of flying. The reactions of the air on the small wing in front therefore are considerably greater than if it passed through space at the flying speed.

The new explanation of Dr. Betz is based on the fact that for a given speed the lift of a plane increases with the angle of incidence until the air stream on the upper surface can no longer follow that surface. If the angle of incidence becomes too big, a new condition of flow develops, the air stream separating from the plane, creating a field of eddies which grows with the angle of incidence. Such eddies have a tendency to form even in the case of small angles of incidence, but the air, passing over the plane, immediately washes them away, and thus maintains a smooth, lift-creating stream. In the case of large angles of incidence this becomes impossible. But if the air stream on top of the plane is reinforced by air passing through the slot in the wing from the under to the upper side, the lift-creating flow conditions can be maintained even with larger angles of incidence. New energy is being supplied to the air stream on top of the plane by the air flowing through the slot, which enables it to continue to wash away the eddies. This energy has to be paid for, however, the phenomenon being accompanied by increased drift of the slotted plane as compared with a plane without slot.

This new explanation is valuable for the reason that it furnishes a basis for judging the value of new plane combinations of the kind referred to, and facilitates the arrangement of systematic test series in a field where the number of possible combinations is almost without limit.

—*Automotive Industries.*

THE NEWS OF THE WEEK

Aeroplanes and the Railroad Strike

In view of the threatened railroad strike, the Manufacturers Aircraft Association on October 17 telegraphed to Secretary of Commerce Hoover a report on the aircraft available for emergency transportation:

"There are at least 750 commercial aircraft immediately available for the general cararriage of passengers, mail and exprss. They are of both land and water, cargo and passenger types. Fifty are in commission in the vicinity of New York. Others in proportion are available out of Boston, Philadelphia, Baltimore, Key West, New Orleans, Kansas City, Dayton, O., Cleveland, O., Chicago, Buffalo, Minneapolis, points in Texas, Los Angeles, San Francisco and Seattle. The aircraft carry from two people, or the equivalent in weight to eleven or twelve, and have a non-stop range of flight from 200 to 800 miles. Arrangements must be made for fuel and service, and advise that municipalities that wish to avail themselves of aerial transportation, place their airports in condition."

The offer to Secretary Hoover was based upon reports now being received by the Association from operators in all parts of the United States. These reports show that there are probably 1,200 commercial aircraft stationed in every part of the country, but it is thought only about two-thirds of these are suitable and available for cross-country flying.

The fifty or more planes in Greater New York are in commission on the various fields on Long Island and New Jersey.

The Aeromarine Plane and Motor Company offers six eleven-pasenger flying boats, twelve six-passenger and five three-passenger, available at Keyport, N. J. and Key West, Fla.

The Curtiss Aeroplane and Motor Corp. has twenty, two and three-place land machines ready at Garden City and reports that their depots in all parts of the country, have several hundred more of similar types tuned up for flight.

The Loening Aeronautical Engineering Corp., whose Flying Yacht has recently been operating between New York and New London at less cost than the cost by rail, is ready for Boston, Philadelphia or Washington service.

Lawrence Sperry has in commission his five-passenger high-lift wing Curtiss J. N. monoplane, the Messenger and a score of Avros.

The Wittemann Aircraft Corp. of Hasbrouck Heights, N. J., reports four land planes. The Wittemann company today received telephone instructions from the Post Office Department to rush completion of five DeHavilands for the Air Mail. These DeHavilands can carry six or seven passengers or 800 pounds of bulky mail.

John M. Larsen has five J. L. monoplanes at Central Park, L. I., each carrying six people. These planes are to leave shortly for the middle west, but will be available in Kansas City or Omaha or can be recalled to New York or sent wherever needed.

At Curtiss Field on Long Island there are three or four five-passenger S. V. A. land planes of the Aero Import Corp. and two Fokkers of the Netherlands Aircraft Co., one carrying five passengers. These ships are already in service.

Reports from over the country state that the Thomas Morse Company at Ithaca, the Glenn L. Martin Company at Cleveland, G. Elias & Bro. at Buffalo, the Dayton Wright Company at Dayton, O., and the Boeing Airplane Company at Seattle are ready to provide services and wherever possible to put more machines in the air. The Dayton Wright Company has three long range cruisers, one of which carries four passengers, and which is in frequent operation between cities of the middle west. Two lines, one land and one water, operate in conjunction with the Boeing Company out of Seattle. The seaplane line connects with Victoria, B. C.

Particularly extensive service can be provided out of Kokomo, Ind., where there is a large air-port with fifteen or twenty machines, Minneapolis with twenty-five or thirty, and San Francisco and Los Angeles. In the two latter cities the California-Curtiss Company, the Mercury Aviation Company and the Rogers Airport have available a hundred planes of various types.

Aerial transportation will fill the demand for the urgent movement of negotiable banking paper, checks, etc., clearing of which will relieve the financial system; it will meet to a great degree the problem of carrying the mails. The Air Mail, now operated only between New York and San Francisco, has contact between New York and the South by way of Washington and could, if advisable, operate two more lines between New York and Chicago, taking in Pittsburgh, Ft. Wayne, etc. The equipment exists and the route is charted between the Twin Cities and St. Louis. Air travel is so common on the Pacific Coast that movement of the mails by aeroplane between San Francisco and Los Angeles is practicable at once. The Seattle-Victoria mail could be extended south to Portland and east to Spokane and Minneapolis.

The same type of aeroplanes capable of carrying the mails can also transport limited quantities of food, but it is believed that the greatest service will be in providing service to government officials or business men on whose travel from point to point may depend the working out of other problems, such as motor transport or the increased utilization of the water ways.

Although no united national effort has been made, airways have been laid out over most of the United States, and there are enough of the seventeen thousand pilots in training to man the ships available.

Fly Battle Plane Mounting 30 Guns

An armored military aeroplane mounted with thirty machine guns capable of spraying 3,000 shots in four minutes has been completed by John M. Larsen, an engineer and inventor, at his aeronautical plant at Central Park, L. I. Carrying Larsen, Brook Hyde-Pierson, pilot, and M. Goodenough, mechanician, the craft will fly to Washington to be inspected by army and navy officials.

The J-L attack plane, as it has been named, is of all-metal construction and has a cruising speed of 141 miles an hour. It has a wing spread of 49 feet and a length over all of 32 feet. A 400 horse-power Liberty motor supplies the power. Its radius of action is 400 miles.

The craft is a monoplane with cantilever wings which do not require exterior bracing. When manned with crew and equipped with 3,000 pounds of ammunition and necessary fuel the plane weighs 5,000 pounds.

Larsen places great stress on the maneuver ability of the plane, which, despite its size and bulk, can be manipulated as easily as the single seater, he says. It can be put through aerial maneuvers such as the loop-the-loop, the Immelmann turn and the like, he declares.

The main battery of armaments consists of twenty-eight machine guns arranged in two sections inside the body. The first section of twelve guns is placed back of the pilot's seat, sixteen other guns are mounted to the rear. The remaining two guns are superimposed on the forward part of the cockpit, where they may be operated by the pilot and a gunner.

The two main batteries of guns are fired by means of three levers, two of them each firing a section and the third, a master lever, exploding the whole twenty-eight. Each gun has been tested to fire 1,500 rounds per minute. It requires only four minutes to replace fresh magazines in all the guns.

Each of the circular drums used in the Thompson machine guns on the plane contains 100 cartridges. The ammunition equipment consists of three drums each for the thirty guns, a total of 9,000 cartridges.

A particular feature of the plane is the armored protection afforded to vulnerable parts. The plane itself is constructed of duralumin, an alloy of alluminium, the metal sheets having a thickness of 25/1,000 of an inch. Vital parts are braced with armor 3/16 of an inch thick, sufficiently strong to deflect both rifle and machine gun bullets, it was said.

Third Armistice Dinner

Reservations from all over the country are being received by the Armistice Dinner Committee of the Aero Club of America and many of the old squadrons are engaging special tables. Last year the 90th, 27th and others made wonderful records in getting their old gangs together, and already this year former members of these squadrons have assured Colonel Hartney, Executive Secretary of the Aero Club of America, their representation will be larger and better organized than ever before. The dinner will be held at the Hotel Pennsylvania.

New England's First Air Mail Delivered

Framingham, Mass.—What was said to be the first aerial mail delivery ever made in New England was completed October 23, when Lieut. R. C. Mossat arrived from Washington by aeroplane with a pouch of letters for Boston and vicinity.

Included in the mail were letters from President Harding, Vice-President Coolidge and Senator Lodge.

LONGEST SEAPLANE FLIGHT

By W. W. WYMAN

THE Aeromarine flying boat Santa Maria has just completed the longest trip ever attempted on this continent by a ship of its kind. This trip of about 8,000 miles was accomplished without accident of any kind to ship or its occupants. It was also made with the hearty co-operation of the United States Navy with the idea and purpose of stimulating civilian interest in aviation, and from this standpoint it was a complete success.

The Santa Maria started from its home at Key West, Florida, where in the winter months it is in regular service carrying passengers and mail between Key West and Havana, Cuba. It flew up the Atlantic Coast to New York City; up the Hudson River, along Lake George, Lake Champlain and the St. Lawrence River to Montreal, thence completely around the Great Lakes to Chicago.

The Santa Maria arrived in Chicago one minute ahead of schedule to take part for two weeks in Chicago's Pageant of Progress, where hundreds took flights in her and were convinced of the comfort and safety of this future mode of travel.

From Chicago the great Santa Maria, which never flies beyond gliding distance to water, wended its way down the Illinois and Mississippi Rivers to New Orleans, from where it followed the eastern shore of the Gulf of Mexico to Key West, completing as history making a trip as the boat, after which it is named, on which Columbus came to this country.

The Santa Maria alighted at prominent cities and towns every two or three hundred miles to obtain gasoline and oil and spent a day or two to carry passengers, as this is the most effective method of convincing the public of the safety and comfort experienced in air travel. We know that without exception every one of the thousands that rode in the Santa Maria were not only pleased, but very enthusiastic about this new method of transportation. We also know that they will spread their enthusiasm to thousands in their respective communities, thus accomplishing the object for which this trip was made. In some places we carried the same party on two or three flights and at several points we carried public officials and prominent business men to the next city on our route.

Many of our passengers had flown in two-passenger land planes, and they said the difference in the riding qualities between these planes and the seven-and-a-half ton fourteen-passenger Santa Maria was about the same as the difference in riding qualities of a Ford and a Locomobile.

All were also convinced of the superior safety of seaplanes, realizing the fact that a seaplane operated with proper conservatism always had a perfect landing surface under it. Both its motors could have stopped dead at any instant and the Santa Maria would have made a perfect landing on the surface of water, which is always level and soft.

Mr. C. F. Redden, President of The Aeromarine Airways, Inc., which owns the Santa Maria, had heard of the wonderful results obtained by the use of Lakeside Aviation Oil in the Army Air Service and he desired to see if he could obtain the same results in the Santa Maria, which is a converted Navy F-5-L Seaplane. So he arranged by telegraph with W. W. Wyman, who has charge of the Aviation Sales and Service Department of the C. L. Maguire Petroleum Company, to have sufficient supply of Lakeside Aviation Oil shipped to each stopping place of the Santa Maria between Chicago and New Orleans. Mr. Wyman, the writer, joined the Santa Maria at Peoria, Ill., and continued with her to New Orleans. The impression and notes of the writer follow:

The most interesting incident occurred about fifty miles south of Peoria. We were flying about 1,500 feet above the river when we passed three separate rainstorms. They were all only a few miles west of us. The central storm was coming from a long, narrow, low-hanging cloud that was very black. This cloud was not much higher than we were and we could see the water pouring over the western edge of this cloud in great streams just like water over a precipice. These streams spread out as they fell and by the time the earth was reached it was like ordinary rain.

We were scheduled to stop at Beardstown, Ill., but when we arrived, there was a stiff wind blowing across the river, which was not very wide, so we kept on until we found a town where the river and wind were going in the same direction. This was Naples, Ill. The only sleeping quarters there were in the only brick building, which was a combination general store, restaurant and hotel. There were six of us, and the best this "hotel" could offer was one room with two double beds. So two of us chartered a Henry and drove to the next town, five miles away, and found a place to try to sleep.

The next morning we hopped back to Beardstown in twenty minutes and filled our engagement. Our reception by Beardstown was all the more cordial because of the disappointment of seeing us fly right by the night before.

At Cairo, Illinois, which is called the little Egypt of this country, the owner of a large store chartered the Santa Maria, taking six of his friends for a half hour's poker game among the clouds—they all won, because all so greatly enjoyed the novelty.

Congressman F. C. Hicks, Chairman of the House Committee on Naval Aviation, joined the Santa Maria at Cairo, Illinois, and continued with her to New Orleans. He made himself one of the "boys" of the party and added to the enjoyment of all. Chamber of Commerce officials buttonholed him at all points and filled his ear with their ideas of what Congress ought to do for their particular district. Mr. Hicks, who represents in Congress the late Col. Roosevelt's home district on Long Island, enjoyed the trip and was observing to add to his fund of knowledge about Naval Aviation. He met and was cordially entertained by several Congressmen who sit on the other side of the House, and delivered many interesting talks at Rotary Clubs and Chambers of Commerce luncheons.

When we arrived at each place we invited the Mayor, officials of the Chamber of Commerce and Reception Committee to take a flight over their town. When we extended this invitation to Mayor Kiel of St. Louis, we found that he had had a hundred invitations to fly, which he had consistently refused. But after he talked with friends who had flown in the Santa Maria, he not only went for a trip himself, but took his son and daughter with him. When the Mayor came ashore he said he felt as safe and as comfortable in the Santa Maria as he did in his automobile.

On account of unforeseen conditions on the way to Baton Rouge we came down on the river near the settlement called Tunica, in Louisiana, and as it was nearly dark we decided to spend the night there.

It did not look very inviting, for we could see only a few cabins and no white people. We secured a boat to take our party of seven ashore and found a few white people who had come down to see what was up. On inquiry, we found a boy of 14 who said he knew a farmhouse where the school teacher boarded, and he thought Mrs. Jeffries would give us some supper and find a place for us to sleep. The boy said it was only about half a mile to this farmhouse, but I'm sure we walked three miles over dusty roads and across fields in the pitch dark. The only lights in the town were oil lamps in the cabins.

We were reluctant to ask for food and lodging for seven at one house, so we asked Congressman Hicks to knock on the door and do the talking and not forget to tell them who he was, as we knew they would feel honored to have a New York Congressman stop with them. The other six of us got in on the Congressman's coattails and all had the best "chow" we had had for weeks. We can all speak highly of southern hospitality. Six of us slept in one room. I was a long time getting asleep, but then slept well. The others said I slept very well, but that they all awoke as soon as I went to sleep.

We had a safe trip to Baton Rouge the next morning, when we took Gov. Parker of Louisiana with us to New Orleans. The Governor made a very congenial passenger and enjoyed the trip immensely.

Well, I was having such a good time living over this trip I nearly forgot to tell the results of the object of my trip.

The air temperature between Helena, Ark., and New Orleans averaged over 100 deg. Fahr. This hot weather and the poor quality, low gravity gasoline we had to use caused the engines to overheat, which made very exacting conditions for any lubricating oil to meet.

Lakeside Aviation Oil maintained its pressure and temperature throughout all these strenuous operating conditions and proved to all aboard the truth of our slogans—"Laughs at Heat"—"Costs less per flying hour." The average consumption of Lakeside was only 48% as much as that of the best oil the Santa Maria had previously used. Mr. Redden now *knows* the good things he heard about it.

During this trip the Santa Maria carried passengers from the age of two years to the age of eighty-four years, and all expressed the same desire — to always travel in the air. We carried more women passengers than men—wonder why?

Herring Spotting

Washington—Having begun investigation of the habits of the eel, British authorities are now devoting their attention to the elusive North Sea herring. Squadrons of seaplanes are employed to locate missing schools and advise British fishermen where they may be found.

A report from the office of the American Trade Commissioner in London says lack of herring has caused serious alarm on the east coast of England. Besides the seaplanes a special boat has been sent out from Lowestoft, the center or the British herring fisheries, to make a survey.

The AIRCRAFT TRADE REVIEW

London-Paris Line to Fly All Winter

Through special efforts by the Air Ministry, British participation in the London-Paris air service is assured for the winter months by an extension of the present temporary subsidy arrangements. Many interested parties declare, however, that the arrangements are inequitable and expensive, and they even seek a revamping of the permanent scheme, which goes into effect next spring, on the basis of recent developments, which seem to make possible a profitable operation of the air route almost without a subsidy.

The scheme proposed involves the Air Ministry permitting approved firms to use Government aeroplanes, paying 2½ per cent. of the initial cost monthly for thirty months, thus acquiring the aeroplanes at 75 per cent. of their cost and on easy payments. There is a further subsidy of £3 for every passenger carried.

Against these subsidy figures Geoffrey de Haviland says his present aeroplane can carry five tons net cargo one mile on one gallon of gasoline and make a speed of 120 miles an hour. He places the initial cost of such a flying machine at £6,000 and its earning capacity at between £150 and £200 a day. He figures the depreciation of the aeroplanes at 20 per cent.

Types just appearing do even better than this. Holt Thomas, founder of the first Paris-London line, says the present DH-18 can carry a ton of freight 100 miles an hour and, "including interest and all charges, carry freight to Paris at a cost of sixpence a pound for a full load and a shilling a pound for a half load."

During the air congress a year ago there were demonstrated two types of flying machines that had been available for more than two years and could carry cargo for three shillings and nine pence and three shillings and seven pence, respectively, a ton a mile. It is now charged that few of these economic types of aeroplanes are in the service of the two companies to which the £50,000 is allotted for seven months just closing in order to meet the subsidized French competition, which prefers to employ obsolete and costly types.

Although it is charged that reliance on this subsidy prevented the use of better types of aeroplanes, enabling the Government to withdraw the subsidy, records of the great Handon airdrome show that the two companies operated during a brilliantly successful season from the viewpoint of efficiency and safety. Thousands more passengers were carried this year than last, of whom at least 50 per cent. were Americans, and there was not a single serious accident throughout the season.

Spring promises to be even better with newer flying machines under a new subsidy scheme and more extended and more frequent service to Paris, Brussels and Amsterdam.

Air Ministry Delegates

Included in Britain's delegation to the Disarmament Conference are the following representatives of the Air Ministry: Air Vice Marshal J. F. A. Higgins, Group Captain J. A. Chamier, Flight Lieut. A. R. Arnold, Flight Lieut. R. Gambier Parry and Mr. W. E. Taylor.

Pioneer Instrument Company

The Pioneer Instrument Co. is doing some very interesting work in the development of aircraft instruments. The partners in the concern are M. M. Titterington, B. H. Goldsborough and Charles H. Colvin.

Mr. Titterington has been closely connected with aircraft matters since 1912, when he built and flew his own plane. Since that time he was connected with the Curtiss Co. and the Sperry Gyroscope Co.

Mr. Goldsborough is in charge of the factory and his experience includes, besides his early shop training, a year of balloon work, eight years in the Navy and three years with the Sperry Gyroscope Co. as installation and test engineer and later as factory manager.

Mr. Colvin's connection with the aircraft industry began in 1913 with the Curtiss Companies in Hammondsport. Since 1914 he has been active in design, test, production and sale of aircraft instruments.

Proposed Inter-Island Air Service for Hawaii

That an inter-island aeroplane mail and passenger service may become a reality was indicated by a letter received recently by the Honolulu Chamber of Commerce from Mr. C. A. Webb of San Francisco, who asked for particulars regarding the possibility of establishing an aerial line between the islands. The line would handle mail and papers, with a few passengers. According to Mr. Webb, he would use 6-passenger flying boats.

Hartford Seaplane Landing

The commanding officer, United States Naval Air Station, Rockaway Beach, Long Island, reports that a landing for seaplanes can be found at Hartford, Conn., in 12 to 14 feet of water, mud bottom, with good beaching facilities; rise and fall of tide 1.4 feet.

Landmarks.—Hartford Travelers Tower, 507 feet.

Supplies of all kinds may be obtained at the Hartford Aviation Field, 2 miles southward of the city.

Sport Farman to Kansas City

The Sport Farman will make its first appearance in the Middle West at the American Legion Flying Meet in Kansas City, November 1st, 2nd and 3rd, where it is entered in four events. The pilot will be Capt. D. H. Robertson. W. Wallace Kellett, representative of the Farman interests in America, with offices at 717 Widener Bldg., Philadelphia, will also be at Kansas City.

Aerial Fire Fighters

Fire fighting by aeroplane is the latest suggestion which is being studied by the Paris Fire Department following the burning of the Magasin au Printemps department store, with a loss of 40,000,000 francs. According to aviators who have proposed the scheme, it will be possible to control any fire within a few minutes with a minimum loss.

Instead of using water and pumps, however, the aviators would be provided with huge bombs which would explode on striking the burning buildings, filling the atmosphere with a gas that would completely choke the flames while being absolutely harmless to the people in neighboring buildings. It is estimated that one aeroplane could carry enough bombs to extinguish a blazing building.

The city's experts, however, are expressing doubt as to the feasibility of the plan, declaring that the air currents set up by the burning buildings would interfere with the aeroplane pilots to such an extent that it would be impossible to drop the bombs on the proper targets, although proponents of the scheme declare that this could be easily overcome by dropping the bombs from a height of a thousand yards.

Experiments will be carried on in the suburbs shortly with a view to ascertaining whether aeroplanes will be made an important feature of every well regulated fire company.

Use of Flying Boat Fleet Offered City

C. F. Redden, president of the Aeromarine Airways, Inc., sent word to Governor Miller and Dock Commissioner Murray Hulbert offering his fleet of flying boats free to the state and city in the event of a railroad strike. The following reply was received by Mr. Redden from the mayor:

"Dock Commissionr Hulbert has submitted to me your letter of October 17 offering in behalf of the Aeromarine Airways to place at the service of the city its entire fleet of aeromarine navy flying boats for use in case of possible emergency arising from the threatened railroad strike. Please accept my very best thanks for placing at the disposal of the city such modern commercial facilities.

"While I earnestly hope that no exigency may arise which will necessitate the employment of this flying boat service, I wish to take this opportunity not only to thank you but also to assure you that your praiseworthy public spiritedness is deeply appreciated."

Lieut. Bartlett Weds

Announcement has just been received of the marriage of Miss Sara Leathers, of Orviston, Pa., to Lieutenant Frank M. Bartlett, Air Service, U. S. Army, on October 5th. Congratulations and best wishes to the happy couple.

Lieutenant Bartlett, who is one of the best-known pilots in the Air Service, is a native of Port Townsend, Washington. He enlisted in the Aviation Section, Signal Reserve Corps, in May, 1917, passed his R.M.A. test on October 6th, and was commissioned a 1st Lieutenant on October 25, 1917. He was promoted to the grade of Captain on August 23, 1917. He performed excellent work as flying instructor both at Kelly Field and Carlstrom Field, acting as Officer in Charge of Flying at both of these stations. He also served two tours of staff duty in the Office of the Chief of Air Service, Washington, D. C. On July 1, 1920, he was commissioned a 1st lieutenant in the Air Service, Regular Army.

Lieutenant Bartlett is now under orders for a tour of duty in the Philippines.

DALLAS ORGANIZES AERIAL POLICE

Mayor Sawnie Aldredge of Dallas

MORE than 2,000 Dallasites gathered on the aviation field at the west end of the Oak Cliff viaduct to witness the swearing in and flights of the newly organized members of the aeroplane branch of the auxiliary police force.

Just before the Commissioner of Fire and Police Louis Turley, attended by Chief of Police Elmo Strait and Chief of the Auxiliary Police W. C. Rice and surrounded by the Board of Commissioners, delivered the oath of office to the pilots, Dudley Mayer climbed into the front seat of his ship, Mayor Sawnie Aldredge stepping into the rear.

The Mayor's ship, the first to leave the field, went skimming across the open space and gracefully rose with a long, dipping sweep. Away over Oak Cliff, out across Trinity Heights, then back across the Trinity River, the sailing boat passed beyond view. To the ends of White Rock, over Highland Park, then the Mayor again was within range of the vision of the field. With a long, low dive the airship came within 200 feet of the earth, then rose steadily, mounting higher up until an altitude of about 1,000 feet was reached, from where it turned and dived almost directly to the field, striking the ground with a gentle bump, slipping along until it came to a stop at the edge of the crowd.

The first remark of Mayor Aldredge was: "Wonderful, truly wonderful! To get a real view of the magnificence of Dallas, one must see it from the sky. It is almost beyond description. Please let me tell first of my special admiration of my pilot. He certainly understands this boat. I thank him and appreciate the courtesy. As its Mayor, I can truthfully say Dallas is a wonderfully beautiful city. I am glad I went. It did not make me sick nor was I at all fearful."

The pilots of the ten airships lined across the field were then called before the Commissioners and instructed as to their new duties. They were directed to take five ships into the air and catch a "pirate" or "bootlegging" plane that had been seen hovering over the city. Using the V-formation, the vessels rose in order and after reaching the proper altitude, assumed the correct formation and sailed out in quest of the "bandit" boat. Then a sixth one was seen riding easily in the clouds, evidently watching an opportunity to alight in some secluded distant field. Immediately, following signals from the earth, the five ships turned and darted in different directions, closing in from all sides upon the "pirate" ship, forcing it to the ground, all six landing just on the edge of the crowd.

Alighting from the planes, the passengers were recognized as newspaper men representing each of the Dallas papers.

Augmenting the three planes stationed at the Ook Cliff aviation field, seven came over from Love Field and participated in the program. The first to arrive was that piloted by H. W. McGraw, with his wife as passenger. Lieutenant C. H. Howard, with Jeff Still, mechanician, followed closely behind, in a Standard. This machine at first looked like a mere speck in the sky, its altitude registering a little over 6,000 feet. Captain S. C. Coon, in a JN-SC or Canadian training plane, was the next arrival. He was followed shortly by H. C. Foster, with Dillard Hamilton as mechanician; J. L. Schroeder and G. G Lamkin in a JN-4D Curtiss; R. W. Vollum, piloting a Curtiss SW, with Major W. B. Atwell as passenger, and J. L. Moran in a JN-4C, with Jack Killingsworth as mechanician.

Chief of the Auxiliary Police W. C. Rice expressed gratification over the showing of the new branch of the auxiliary force. He said:

"The capture of the 'pirate' air boat was so realistic that it encourages us to the belief that hereafter when Dallas might be threatened from the sky or the regular police require the services of airmen, our men will not only be prompt in answering the emergency call, but will be able to cope with the situation. Aeroplane work has long appealed to me as being a needy service for police work.

"I feel sure the pilots will render a good account of themselves and even in the cases of stolen automobiles, it is not beyond the possibility that our airships can detect the criminals, particularly those fellows who steal cars and take them to lonely spots and strip them. They can be seen from the skies and the police notified of their location."

Mayor Aldredge also expressed gratification with the work of the air service of the police department, saying:

"Now we have a class of men at our disposal that will render criminal work much more difficult to get away with. I congratulate Chief Rice, I thank the men for their loyalty and willingness to aid in keeping our beautiful city free of crime."

Commissioner Turley and Chief of Police Strait left the field early because of duties elsewhere, but before their departure called the pilots and their assistants before them and commended them in glowing terms for their work. Mr. Turley told the pilots that badges signifying their membership in the auxiliary air service will be furnished them within the next few days.

While the planes were gliding through various formations and performing stunts over the city, Chief of the Fire and Police Signal System, Henry Garrett, flashed out wireless signals to the pilots from his automobile wireless station on the field below.

Lineup of Planes and Aerial Police Reserve of Dallas

ACCIDENTS IN COMMERCIAL AVIATION

A report prepared for the Secretary of Commerce by the Information Department of the Manufacturers' Aircraft Association states that, based upon the most trustworthy available information, it is estimated that 1200 aircraft are engaged in commercial flying in the United States today. A conservative estimate places the mileage flown by these craft during the period, January 1 to June 30, 1921, at 3,250,000 miles.

In the first six months of 1921 there were 40 serious accidents in civil flying, not including accidents to government-owned machines, resulting in death to 14 persons and injury, more or less serious, to 52. In 18 instances there were no casualties. The 14 lives were lost in 10 accidents, and injury to the 52 was caused in 20 accidents. The report gives the following requisite for safe flying:

1. A machine sound, aerodynamically and structurally.
2. An engine of sufficient power and which operates satisfactorily.
3. A competent, conservative pilot and navigator.

4. Air ports and emergency landing fields, sufficiently close together to insure gliding to safety.

5. Nation-wide weather forecasts specialized and adapted to the needs of fliers.

6. Nation-wide chart of air routes.

Each of the 40 accidents recorded was caused by deficiency in one or more of the above elements. Seventeen were attributed to the pilot, perhaps through carelessness, perhaps incompetence, perhaps bad judgment combined with other factors. There is no doubt that a good pilot can guide a poor machine to safety with greater chance of success than a poor pilot can operate a first-class craft. Therefore, at the very top of the list of government needs is placed the examination and licensing of pilots. During the war rather more than 17,000 young men were trained to fly. The art of flying can not be retained perpetually without practise, nor can it be maintained at a high degree of competency without regular examination. Ten accidents are attributed to inadequate landing fields or to the total lack of landing facilities. During the war the Army and the Navy acquired many terminals, most of which have since been abandoned. The fragmentary remainder has been slightly added to by the Air Mail, municipalities and private enterprise, but the United States is today wofully lacking in air ports for even the 1,200 craft in operation. A survey made by the Manufacturers' Aircraft Association discloses that in the United States and its possessions there are only 271 land and water air terminals. many of which are concentrated in certain localities. Of the 271 listed air ports, 145 are controlled by municipalities, 69 are privately owned, and the others are a part of the Army and Navy air services, and the Air Mail.

While only two accidents are attributed to the lack of weather reports and two to the lack of clearly defined routes or limitations in travelling between or over cities, it is certain that aerial transport can not develop until these factors are met. As an illustration, two of the worst accidents in our flying history are attributed to these causes. As one was naval and the other military, they cannot be included in the civil table, although in their results they were as harmful to civil flying prospects as though they had occurred to private individuals.

Equal in importance with learning the qualifications of pilot and navigator is inspection of aircraft and engines. Out of the forty accidents, eleven may be attributed to faults. which proper inspection probably would have revealed—three concerning the plane, six the engine and two an accessory. In many instances it is found that the engine is blamed when really it is an accessory that is at fault. An analysis of the Pulitzer Race last year proved this. When it is remembered that operators of motor cars are required to qualify and that motor cars are periodically placed under rigid inspection, it is astonishing to learn that *anyone* can take *any* sort of flying machine into the air at the present time, with the consequent peril not only to himself and his passengers, but to many persons below.

Eight of the forty accidents occurred during stunting. In these eight accidents seven persons were killed and twenty-six injured—exactly 50% of the total. In other words, stunt flying in unrestricted areas was responsible for as many casualties as all other elements combined. While stunt flying is necessary to testing and essential to warfare—and it is believed advisable that all pilots know how to stunt so that in case of an emergency, when only a stunt will save their craft, they will be able to act quickly, with understanding and without fear—the habit of stunting for thrill is dangerous, fatal in many instances and always harmful to civil flying. A government system of control, limiting stunting to certain areas will meet this unfortunate menace to aeronautics.

The danger of collision in the air is not great, providing levels of flight for aircraft under way are established and observed, and providing stunting is controlled. The only collision reported occurred during a stunt performance which resulted fatally.

Two accidents are reported through carelessness on the field. In one notable instance the pilot, in order to avoid the crowd which surged out in front of his machine as he was taking off, deliberately wrecked his craft. It is observed that at every flying demonstration, even at locally policed fields, the spectators ignore warnings and must be forced to keep back. This is illustrated by the long list of automobile race track casualties, where spectators got in the way. Only federal rules rigidly enforced are able to meet this condition.

Finally, five accidents are attributed to "unknown" causes. The hope of preventing accidents depends on learning—then correcting—the cause of each. It is evident government authority is required to obtain information in such cases.

FLIGHT ROUND THE WORLD

IN an interesting article in the London *Observer*, Major C. C. Turner discusses round-the-world flight, as follows: At least two British projects for flying round the world have been under consideration for some time, and it is certain that attempts will be made in the course of the next few months. In the main, such attempts will belong to the domain of adventure, and will throw little light on flight problems. No doubt success would be highly creditable for any particular type of aeroplane, but more interesting will be the selection of the route with reference to seasons and prevailing winds, and the skill in navigation displayed.

One of the first questions to be decided by these expeditions is whether the circuit of the planet shall be from west to east or from east to west. Sir Ross Smith, who will fly a two-engine Vickers-Napier amphibian, and will be accompanied by his brother and Sergeant Bennett (who were with him on his flight to Australia), has decided in favor of the west-east way, and for this he has the precedents of his flight to Australia, and Sir John Alcock's crossing of the Atlantic. He proposes to follow his London-Australia route as far as Calcutta, whence he will travel east and then north-east by the Asiatic shore of the Pacific to the Arctic Circle, crossing to Alaska, and then by way of British Columbia and the great lakes. He intends to visit New York, and then to return northwards to Nova Scotia for the dash across the Atlantic.

One of his chief cares will be to avoid the Indian monsoon season and to choose the period that will also fit in with the brief period of clear weather in the extreme north of the Pacific, which is so often fogbound. But for the greater part of the flight, and especially where the ocean has to be crossed, he will have the help of westerly trade winds.

East to West

The principal other British project will be for a big flying boat, and will take the flight in the opposite direction, using the north-east trades north of the Equator.. This route would take in Lisbon and the Azores, the American continent at its narrow middle, San Francisco, and, again on the trade winds, would go by way of Honolulu or Crusoe Island to Jaluit, Guam, and Manila. Or an alternative would be to cross the American continent at the north, taking in the great lakes, and following the Aleutian Islands and the Asiatic side of the Pacific. Much will depend upon the data that is being collected with great difficulty concerning the fog seasons in the north of the Pacific, and the weather on the Asiatic side of that ocean.

Apart from crossing in the extreme north, there is a possible route south of the Behring Sea, where the greatest separate stage would be between Unalaska and Petrapavlovsk, 1,260 miles, and thence to Yokohama, 1,380 miles. This, however, would almost certainly have to be taken from west to east on account of the prevailing winds.

Great Sea Distances

On the Honolulu-Jaluit line the greatest distances are San Francisco-Honolulu, 2,090 sea miles, and Honolulu-Jaluit, 2,130 sea miles. The greatest sea distance hitherto flown was the 1,680 sea miles by Sir John Alcock, but that was by an ordinary land aeroplane. Sir Ross Smith's choice of the northern corner of the Pacific is obviously due to the need to evade the north-east trades that would be met by way of Honolulu to San Francisco, a route of long sea distances.

The South Asiatic coast and the Philippines are subject to typhoons, most frequently met in July, August and September, and least often in February.

A project for crossing the Atlantic from east to west is engaging the Portuguese, who have chosen a British seaplane for the purpose. It is understood that the United States Naval Flying Service will soon attempt the crossing of the Pacific by way of Honolulu. The international air congress soon to assemble at Paris will discuss the advisability of establishing a competition for the round the world flight. It will be remembered that the American Aero Club were recently occupied with preparations for such a competition, but that the project fell through.

In connection with round the world flight a test which has just been completed to check up mail speed is of interest.

With a view to ascertain the time required for a letter to go around the world for the purpose of comparing with the time

(*Continued on page* 187)

EFFECT OF VARIATION IN LOAD FACTOR ON STRUCTURAL WEIGHT OF WINGS

By R. A. MILLER

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Introduction

THE object of this investigation is to determine the effect of variations in load factor or useful load upon the sizes and weights of the various parts of the wings.

Assuming the formulas used by the Air Service for the solution of lift trusses and the design of spars and struts to be correct, a definite relationship is established between the useful load and the sizes of members so that it is possible for the designer to predict the resultant sizes and weights due to variations in the useful load.

It is shown that with the present methods of design the area of the spar is of first importance and that within certain limits the area of the routed spars may be arranged without regard to the effect upon the moment of inertia.

The investigation is conducted throughout in terms of the load factor, but by a simple computation the result of changing the weight of useful load instead of the load factor may be estimated.

Two sets of computations are made, one for the RAF-15 section and one for the USA-27 section, with the wing area aspect ratios, gap chord ratios, stagger and weights the same in each case, thus showing any difference in effect on a thin wing and on a moderately think one.

Consideration of the subject will show that the weight of the covering will not be affected by variation in the load factor, and that the weight of the loading and trailing edges, ribs, drag wires, etc., will be subject to little if any change. The main struts and spars will change in weight and the total weight will change in proportion. This study is therefore limited to the lift trusses.

The stresses in a typical lift truss under a load factor of 1.0 are computed, multiplied by various load factors, trusses designed for the resulting stresses, and the weights compared.

Conclusions

1. The area of spars varies directly with the load factor.
2. The area of struts varies with the load factor and the increase in area is at a slightly smaller rate than the increase in load factor.
3. The weights of the lift truss members vary with their respective areas and therefore increase at a rate slightly less than that of the load factor.
4. In considering changes in design necessitated by changes in useful load it will be on the safe side to assume that the areas and weights of members of the lift trusses vary directly with the per cent increase in the load factor, and for small increases the error will be negligible.
5. If the spars are designed as light as is consistent with good practice, small increases in useful load with the thicker wing sections may be met by decreasing the routing.
6. The structural weight of wings varies with the load factor, but does not increase as rapidly as the load factor.
7. When an increase of useful load is made in an aeroplane, it is safe to predict that the sizes and weights will increase in proportion, though the design of the members should be checked before the new sizes are given final approval. This prediction should give fairly accurate sizes, but will give weights that are heavier than they are found to be when the design is checked.

Assumptions

1. In this investigation two flight conditions were considered, high incidence and low incidence.
2. The following assumptions were made with respect to the location of the center of pressure, the angle of incidence, and the value of L/D:

U. S. A. 27

Flight Condition	Angle of Incidence	L/D	Position of Center of Pressure
High Incidence	16°	9.2	27.4 per cent
Low Incidence	−2°	7.8	63.4 per cent

R. A. F. 15

High Incidence	12°	10.7	29.0 per cent
Low Incidence	0°	8.1	44.3 per cent

3. The standard decrease in loading on the wing tips was assumed.
4. The lower wing was assumed to be 86 per cent as efficient as the upper wing in high incidence and 87 per cent as efficient as the upper wing in low incidence, in accordance with division of load between wings as recommended in Art. 44 of "Structural Analysis and Design of Aeroplanes."
5. The wing tips were assumed to be square.
6. The spars were assumed to be hinged at the cabane struts.
7. The lift wires were crossed so that their drag effect would relieve the direct stresses in the spars.
8. The weight of the wings was assumed at 1.00 lb. per sq. ft. and the gross wing loading was assumed at 8.0 lb. per sq. ft. in computing the stresses in the struts and spars. No correction of the stresses was made to allow for the actual weights of each design.
9. The spars were assumed to be at 12 per cent and 67 per cent of the chord.
10. The aerodynamic characteristics assumed for the USA-27 section were obtained from the wind tunnel tests at M.I.T. in November, 1920; those for the RAF-15 section were obtained from the wind tunnel test at M.I.T. in December, 1919.
11. The location of the outer strut, bay 1-2, and cantilever length were determined by the recommended proportions in Art. 34 of "Structural Analysis and Design of Aeroplanes."
12. The drag truss was divided into 3 panels between the cabane and outer struts.

General Data

Weight of aeroplane, without wings......	2400 lbs.
Total span of wings....................	31.5 ft.
Gap	68 in.
Chord of both wings..................	68 in.
Stagger	+13.6 in.
Length of center section, both wings....	30 in.
Length of bay, both wings.............	110 in.
Length of cantilever section, both wings..	64 in.
Area of upper wing....................	178.6 sq. ft.
Area of lower wing....................	164.4 sq. ft.
Weight of wings	343 lbs.
Distance from leading edge to front spar..	8.16 in.
Distance from leading edge to rear spar..	45.56 in.

Computations

1. The stresses, moments, etc., in the lift trusses are computed for a load factor of 1.0 according to the method in Chapter III of "Structural Analysis and Design of Aeroplanes," the distribution between the front and rear lift trusses effected, and the direct stress in the spars corrected for the drag truss stresses.
2. Multiplying by the various load factors, we have the moments, shears, stresses, etc., as shown in Tables I and II.
3. The spars were designed for both the USA-27 section and the RAF-15 section for the stresses, moments, etc., resulting at the various load factors the method in Art. 174 of "Structural Analysis and Design of Aeroplanes" being used.
4. The struts were designed for the loads at the different load factors with sizes as shown in Tables IX and X. The method in Art. 91 of "Structural Analysis and Design of Aeroplanes" was used, combined with Euler's formula for pin-ended columns:

$$P = \frac{\pi^2 EI}{L^2} \text{ or } I = \frac{PL^2}{\pi^2 E}$$

Assuming a standard streamline wood strut with a fineness of 4, with L = the length of the strut cross section and D the width.

$$I = .0432LD^3$$

As $L = 4D$

$$I = .1728D^4$$

$$A = .730LD = 2.92D^2$$

$$A^2 = 8.53D^4 \text{ and } \frac{A^2}{49.34} = .1728D^4$$

Then $$I = \frac{A^2}{49.34}$$

Then $\frac{A^2}{49.34} = \frac{PL^2}{\pi^2 E}$ and $A = .001768 \times L \times \sqrt{P}$

where A = cross sectional area,
L = length of strut, and
P = comp. in strut

5. Curves were plotted showing the variation of the cross sectional area of the spars in the routed portion in terms of the load factor, see Fig. I.

6. Curves showing the variation in weight of the spars in terms of the load factor were plotted, see Fig. II. In computing these weights it was assumed that there would be a 10 in. unrouted length at the strut points, a 12 in. unrouted length at the wing tips, and 5 in. was subtracted from each 12 in. unrouted portion at the wing tips to allow for the taper of the spars at that point. The spars were considered to be of spruce and to weigh 27 lbs. per cu. ft.

7. Curves were plotted showing the variations of the cross sectional area of the outer struts in terms of the load factor, as shown in Fig. III.

Discussion

1. The characteristics of the spars designed show that the area varies directly as the load factor.

2. It will be observed that the weight of the spar varies with the load factor, but not directly with it, as the curves shown in Fig. II take the form Ax + BY = K. For this particular case, K is undoubtedly the excess area added at the strut points and compression ribs to provide sufficient area for the fittings, to transfer stresses from the ribs, struts and wires to the spars and to each other, and to stiffen the spars for drag bending. Doubling the load will not double the weight of the spar, though the error in any case is on the safe side, and for small increases in the load factor the error would be so small as to be negligible.

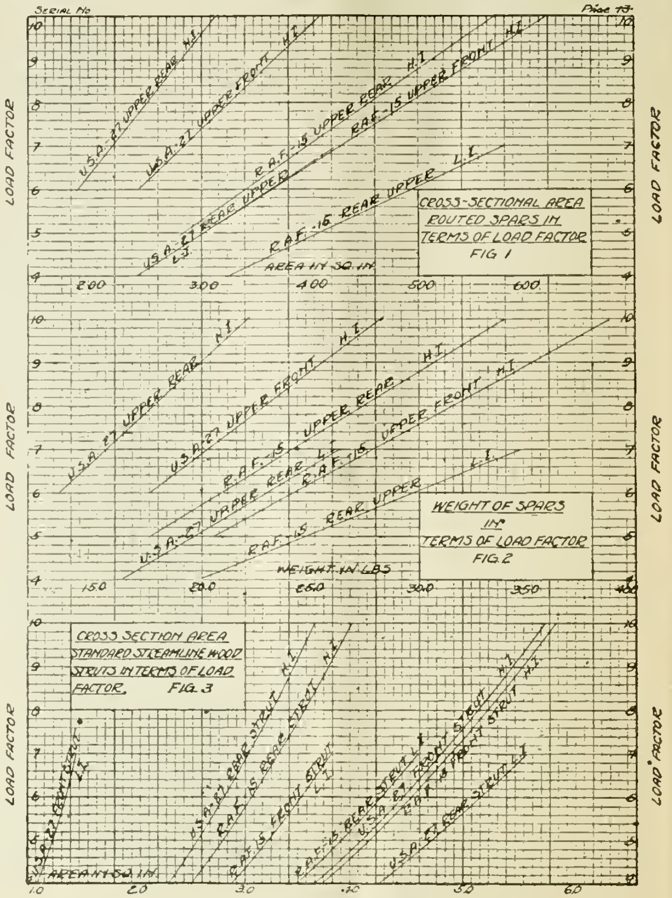
3. The deflection of a spar with constant load and span varies inversely as the moment of inertia, so that an unrouted spar shows greater deflection for a given load than a routed spar of the same area and center height.

4. While the computations made during this investigation have not been as comprehensive in regard to the effect on the F.S. of variations in the moment of inertia as might be desired, they indicate that for a given load and with constant area and center height, small variations in the amount of inertia have little if any effect upon the F.S.; and that with constant load, constant span, constant area of the routed portion and center height, the moment of inertia may vary at will with little effect upon the F.S., so long as the ratio of the area of the routed portion to the area of the unrouted portion remains between 50 per cent and 80 per cent. However, the characteristics of a spar, a typical case being listed in Table XI, would indicate that as the area ratio approaches 80 per cent the best spar in regard to minimum weight is obtained.

5. In many cases, more especially with the thicker wing sections, when it is desired to amend a design for small increases in useful load, the area of the spar can be increased by decreasing the routing up to a point where the ratio of the area of the routed portion to that of the unrouted portion equals 75 per cent to 80 per cent, thus keeping the spar as light as possible and effecting a saving in the redesign of ribs, fittings, etc.

6. According to the formula for struts, the area varies with the length and with the square root of the load.

7. The curves for the area in terms of the load factor, see Fig. III, show that with the length constant, the curve for the area in terms of the load factor is nearly a straight line.



FIGURES-1,2,3

8. If the area of a strut with constant length be increased in proportion to the load factor, the error will be on the safe side in any case, and for small increases in the load factor the error will be negligible.

9. The curves in Fig. II show that the USA-27 section has lighter spars than the RAF-15 section, and the curves in Fig. III show that the USA-27 section has a lighter front strut, while the RAF-15 section has a lighter rear strut due to the difference in center of pressure travel. However, computations will show that the two struts with the RAF-15 section are but very little lighter than those with the USA-27 section at the load factors of design for pursuit aeroplanes. With the thicker wing section, the ribs and compression struts would be heavier, but the difference in weight would be small as it would be due mostly to increased web area. Because of the greater spar height in the USA-27 section it is possible, in spite of the increased center of pressure travel, to design spars so much lighter than with the RAF-15 section as to overcome the increased weights due to heavier struts, ribs and compression struts and to effect a considerable saving in the structural weight of the wings.

A Cute Little Aviator

How a mouse took a ride in an aeroplane is being discussed over in Plainfield, N. J., where Harris W. C. Browne, who has a D. H. 6 which he keeps in a hangar on Greenbrook Road, took his ship out one morning last week and when up about 2,000 feet was surprised to see a field mouse running along the back of the front cockpit. The little fellow did not seem to be scared at all, and after looking around for a moment sprang down into the cockpit and disappeared from the view of the pilot. When the plane landed it was discovered that the mouse had gnawed a hole in the seat cushion, taken out some hair and built a nest in a corner under the life belt. The aeronautic mouse was allowed to escape and is probably the only mouse in existence that ever went up 2,000 feet in a plane and lived to tell the tale. The question is, what would Ruth Law have done if she had been the pilot?

Montgomery Field Record

Altitude records made by planes from the Montgomery Air Intermediate Depot were broken recently when a machine of the De Haviland 4B type, with 1st Lieut. Lloyd Barnett and James Wilson, civilian mechanician at the depot, on board reached the height of 20,300 feet, nearly four miles above the earth's surface. Possibly this record may not be equalled throughout the country by machines of similar type and equal weight to the Montgomery plane, which was about 5,000 pounds.

While natives of Montgomery, clad in Palm Beach suits, were sweltering in a temperature which ranged high in the eighties, the flight pilot and his civilian companion, who left the ground four miles outside of the city proper, came near freezing at the height their machine attained, although they wore winter clothing. The two men also experienced much difficulty in breathing in the rarefied atmosphere.

PRELIMINARY CALCULATION OF CYLINDER DIMENSIONS FOR AIRCRAFT ENGINES

By OTTO SCHWAGER *

THE hitherto customary methods for calculating cylinder dimensions rest on the assumption of a definite average working pressure, whose more or less accurate valuation depends on the results of previous experiments. Consequently they are to a certain extent unreliable. It is especially important in building aircraft engines to determine the requisite dimension as accurately as possible, in order that the weight required for a given power shall not be excessive. The following calculation method depends therefore on the air requirement of the fuel.

I. Air Requirements

Gasoline has a heat value of $h_u = 10000$ to 10500, or an average of 10250 heat units (HU) per kilogram. The composition of gasoline is not constant. We may assume an average composition (by weight) of

$$85.5\% \; C + 14.5\% \; H$$

The combustion of 1 kg. of gasoline therefore requires

$$0.855 \; . \; \frac{8}{3} \; 0 + 0.145 \; . \; 8 \; 0 = 3.44 \text{ kg. } 0$$

corresponding, for an average composition of the air of 23.6% 0 and 76.4% N, to

$$\frac{3.44}{0.236} \sim 14.6 \text{ kg. air.}$$

If we take as the normal conditions of the air 15°C and 760 mm. Hg., corresponding to an air density of $\sim$ 1.2 kg. per cu.m., then $\frac{14.6}{1.2} \sim 12.2$ cu.m. of air will be required for the combustion of 1 kg. of gasoline.

For complete combustion a certain excess of air is, however, advisable, which for aircraft engines may be set at 10% for economical consumption. The actual air consumption for the combustion of 1 kg. of gasoline in a recently built aviation engine is therefore

$$(1 + 0.1) \; . \; 12.2 = 13.4 \text{ m.}^3$$

The volume of 1 kg. gasoline vapor may be set at 0.27 cu.m. The volume of a mixture containing 1 kg. of gasoline, with an average of 10250 heat units, is therefore

$$13.4 + 0.27 = 13.67 \text{ m.}^3$$

and hence the thermal value of 1 cu.m. of the fuel mixture, at 15°C and 760 mm. Hg. is

$$H_o = \frac{10250}{13.67} \sim 750 \text{ HU/m.}^3$$

This thermal value of the mixture may be advantageously employed in the preliminary calculation of the cylinder dimensions for a given engine power.

Under other atmospheric conditions then 15°C and 760 mm. Hg., the thermal value of the mixture changes in proportion to the density of the air and the absolute "heat per cubic meter" may be expressed by

$$H = H_o \; . \; \mu \text{ in } \mu = \frac{273 + 15}{273 + t} \; \frac{b}{760}$$

or the relative density of the air.

II. Preliminary Calculation of Cylinder Dimensions and Fuel Consumption

Designate by N_e the desired brake horsepower of the engine;

μ the relative air density for which N_e is desired;
n the r.p.m. of the engine;
η_m the mechanical efficiency;
η_t the thermal efficiency;
η_g the quality of the cycle efficiency (degree of completeness of the diagram);
Q the heat consumption of the engine in HU per hour;
q the heat consumption in HU per HP hour;
(V_h) theoret, the theoretically required fuel mixture in cu.m. per hr.;
η_l the delivery efficiency of the engine working as an air-pump;
$(V_h)_{\text{eff}} = \frac{(V_h)_{\text{theoret}}}{\eta_l}$ the actually required suction-stroke volume in cu.m. per hr.;
v_h the total stroke space of the engine in l;
η_w the economical efficiency;
b the fuel consumption in grams per HP hour;

The hourly heat consumption of the engine is calculated by

$$Q = \frac{N_e \; . \; 632}{\eta_m \; . \; \eta_t \; . \; \eta_g} \text{ HU/hr.}$$

Since 1 cu.m. of the mixture at the relative air density μ has a heat content of $H = H_o \mu$, the theoretical hourly intake requirement of the mixture is calculated by

$$(V_h)_{\text{theoret}} = \frac{Q}{H_o \; . \; \mu} = \frac{N_e \; . \; 632}{\eta_m \; . \; \eta_t \; . \; \eta_g} \; . \; \frac{1}{H_o \; . \; \mu} \text{ m}^3\text{/hr.}$$

and the actually required suction-stroke volume by

$$(V_h)_{\text{eff}} = \frac{N_e \; . \; 632}{\eta_m \; . \; \eta_t \; . \; \eta_g} \; . \; \frac{1}{H_o \; . \; \eta_l} \; . \; \frac{1}{\mu} \text{ m}^3\text{/hr.}$$

For a four stroke cycle engine there follows herefrom the total stroke volume in l (liters)

$$v_h \doteq \frac{N_e \; . \; 632}{\eta_m \; . \; \eta_t \; . \; \eta_g} \; . \; \frac{1}{H_o \; . \; \eta_l} \; . \; \frac{1}{\mu} \; . \; \frac{1000 \; . \; 4}{60 \; . \; n \; . \; 2} \; l.$$

$$\boxed{v_h = \frac{21100 \; . \; N_e}{\eta_m \; . \; \eta_t \; . \; \eta_g \; . \; n} \; . \; \frac{1}{H_o \; . \; \eta_l} \; . \; \frac{1}{\mu} \; l.}$$

This general fundamental comparison for the total stroke volume of the engine applies to every kind of engine, whether it be an engine of ordinary construction whose power decreases with the altitude or a high altitude engine, over-compressed or over-dimensioned. For the latter μ must be given a value corresponding to the altitude until constant engine power is reached. For ordinary engines $\mu = 1$.

The degrees of efficiency to be used in the equation depend on the kind of engine, whether it is air or water cooled, fixed or rotary (ordinary or Siemens-Halske type) and further from the method of construction of the cylinders, whether the valves are in the cylinder heads or in side chambers. For the most important kinds of aircraft engines, the different degrees of efficiency are calculated as follows:

(*a*) *Water-cooled fixed engines* (*hanging valves in the cylinder head*)

$\eta_m = 0.85$ to 0.9 (For safety's sake, it is better to use 0.85 in calculations).

$\eta_g = 0.8$ to 0.85 (Average 0.825).

$\eta_l = 0.85$ (For gas velocities up to 100 m. per second based on the highest piston speed to be constantly attained with safety).

η_t depends on the degree of condensation. It is

$$\eta_t = 1 - e^{1-x}$$

in which x = 1.35.

(*b*) *Air-cooled Stationary Engines*

On account of the hotter gliding surfaces, especially of the piston,

$$\eta_m = 0.82$$

The quality is not much poorer than for water-cooled engines, only for engines with lateral valve chambers it is poorer on account of the larger cooling surface of the combustion chamber. It may be set at

$\eta_g = 0.77$ for engines with later valve chambers and

$\eta_g = 0.8$ to 0.82 for engines with valves in the cylinder heads.

The efficiency of supply for like gas velocities, as for water-cooled engines depends according to the quality of the cooling, on the uniform laving of the heat conducting surfaces, the avoidance of overheated places in the combustion chamber, etc. $\eta_l = 0.77$ to 0.8. Only under especially favorable conditions with gas velocities below 70 m. per second, can $\eta_l = 0.85$, as in water-cooled engines. Hereby, as in all othes cases, mechanically operated intake valves are essential.

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* "Zeitschrift fur F & M," December 31, 1920, translated by the National Advisory Committee for Aeronautics.

(c) *Rotary Engines*

The following values may be used:

$\eta_m = 0.82$;

$\eta_l = 0.77$ to 0.8;

$\eta_g = 0.65$ to 0.7 (average 0.68).

The quality is therefore considerably poorer than for fixed engines, because an excess of fuel is used for rotary engines, in order to prevent the combustion of the lubrication oil (which gets into the combustion chamber in considerable quantities) and to keep the engine cool. The thermal value of the mixture is therefore higher for these engines and indeed H_o equals 800 to 900 (average 850) heat units per cubic meter.

Furthermore, in the case of rotary engines, it must be remembered that a certain amount of power is absorbed by the cooling resistance, which in ordinary rotary engines, at 1250 r.p.m., is from 8 to 12%, and in the Siemens-Halske type, at 900 r.p.m., is from 4 to 6%.

A still broader efficiency, which may be called the cooling efficiency η_v and may be inserted in the general fundamental quation. The following may be taken as its average values:

$\eta_v = 0.88$ to 0.90 for ordinary rotary engines;

$\eta_v = 0.95$ to 0.96 for the Siemens-Halske type.

From the efficiency, the anticipated fuel consumption per HP-hour is calculated as follows:

The economical working or over-all efficiency is

$$\eta_w = \eta_m \cdot \eta_t \cdot \eta_q \text{ resp.} = \eta_m \; \eta_t \; \eta_g \cdot \eta_v$$

and the heat consumption per HP-hour is

$$q = \frac{632}{\eta_w} \text{ HU/HP-hr.}$$

from which is obtained the fuel consumption

$$b = \frac{q \cdot 1000}{h_u} \text{ g/HP-hr.}$$

III. Examples

In the following examples, the serviceability of the above method of calculation and the correctness of the efficiency values are demonstrated.

(a) *Water-cooled Fixed Engine (ordinary engine)*

$N_e = 180$ HP, $\mu = 1$

$n = 1400$ r.p.m.

$\epsilon = 4.65$, corresponding $\eta_t = 0.416$

$$v_h = \frac{21100 \cdot 180}{0.85 \cdot 0.416 \cdot 0.825 \cdot 1400} \cdot \frac{1}{750 \cdot 0.85} \cdot \frac{1}{1} \sim 14.6\ l$$

$$\eta_w = 0.85 \cdot 0.416 \cdot 0.825 = 0.292$$

$$q = \frac{632}{0.292} = 2160 \text{ HU/HP-hr.}$$

$$b = \frac{2160 \cdot 1000}{10250} \sim 210 \text{ g/HP-hr.}$$

This corresponds very closely to the 160 HP Daimler-Mercedes $DIII_a$, which gives about 180 HP at d = 140 mm., s = 150 mm., i = 6, hence $v_h = 14.7\ l$, $\epsilon = 4.65$ and n = about 1400, and averages about 200 to 220 grams of gasoline per HP-hr.

(b) *Water-cooled Engine (high altitude)*

$N_e = 185$ HP, remaining constant to $\mu = 7$

$n = 1400$ r.p.m.

$n = 1400$ r.p.m.

$\epsilon = 6.3$, corresponding $\eta_t = 0.47$

$$u_h = \frac{21100 \cdot 185}{0.85 \cdot 0.47 \cdot 0.825 \cdot 1400} \cdot \frac{1}{750 \cdot 0.85} \cdot \frac{1}{0.7} \sim 19\ l$$

$$\eta_w = 0.85 \cdot 0.47 \cdot 0.825 = 0.33$$

$$q = \frac{632}{0.33} = 1920 \text{ HU/HP-hr.}$$

$$b = \frac{1920 \cdot 1000}{10250} = 187 \text{ g/HP-hr.}$$

Here there is excellent agreement with the 185 HP-BMW IIIa engine, which still gives 185 HP with d = 150 mm., s = 180 mm., i = 6, hence $v_h = 191\ l$, n = 1400 r.p.m., $\epsilon = 6.3$ and $\mu = 0.7$, with a fuel consumption of 185 to 190 g/HP-hr.

(c) *Air-cooled Fixed Engine (normal engine with lateral valves)*

$N_e = 74$ HP, $\mu = 1$

$n = 1620$ r.p.m.

$\epsilon = 4$, corresponding $\eta_t = 0.384$

$$v_h = \frac{21100 \cdot 74}{0.82 \cdot 0.384 \cdot 0.77 \cdot 1620} \cdot \frac{1}{750 \cdot 0.77} \cdot \frac{1}{1} \sim 6.9\ l$$

$$\eta_w = 0.82 \cdot 0.384 \cdot 0.77 = 0.242$$

$$q = \frac{632}{0.242} = 2610 \text{ HU/HP-hr.}$$

$$b = \frac{2610 \cdot 1000}{10250} = 254 \text{ g/HP-hr.}$$

Here there is also good agreement with a similar-powered engine, the 70 HP Renault, which gives about 74 HP with d = 95 mm., s = 120 mm., i = 8, hence $v_h = 6.8\ l$, n = 1620 r.p.m., $\epsilon = 4$, with a fuel consumption of 260 g/HP-hr.

(d) *Air-cooled Fixed Engine (modern radial with overhead valves)*

$N = 345$ HP, $\mu = 1$

$n = 1650$ r.p.m.

$\epsilon = 5$, corresponding $\eta_t = 0.43$

$$v_h = \frac{21100 \cdot 345}{0.82 \cdot 0.43 \cdot 0.82 \cdot 1650} \cdot \frac{1}{750 \cdot 0.85} \cdot \frac{1}{1} \sim 24\ l$$

$$\eta_w = 0.82 \cdot 0.43 \cdot 0.82 = 0.289$$

$$q = \frac{632}{0.289} = 2190 \text{ HU/HP-hr.}$$

$$b = \frac{2190 \cdot 1000}{10250} = 214 \text{ g/HP-hr.}$$

These values correspond well with the English A.B.C.-Dragonfly engine, which, with d = 5.5 in. or 139.7 mm., s = 6.5 in., or 165.1 mm., i = 9, hence $v_h = 22.8\ l$, n = 1650 r.p.m., has a power of $N_e = 340$ BHP ~ 345 HP, with a fuel consumption of 0.56 pint/BHP ~ 220 g/HP-hr.

(e) *Rotary Engine (ordinary)*

$N_e = 120$ HP, $\mu = 1$

$n = 1200$ r.p.m.

$\epsilon = 5$, corresponding $\eta_t = 0.43$

Taking as a basis

$\eta_m = 0.82$, $\eta_g = 0.68$, $\eta_l = 0.77$, $\eta_v = 0.88$ and $H_o = 850$ HU/m³

we obtain

$$v_h = \frac{21100 \cdot 120}{0.82 \cdot 0.43 \cdot 0.68 \cdot 1200} \cdot \frac{1}{850 \cdot 0.77} \cdot \frac{1}{1} \cdot \frac{1}{0.88} \sim 15.3l$$

$$\eta_w = 0.82 \cdot 0.43 \cdot 0.68 \cdot 0.88 = 0.21$$

$$q = \frac{632}{0.21} = 3010 \text{ HU/HP-hr.}$$

$$q = \frac{3010 \cdot 1000}{10250} = 3010 \text{ HU/HP-hr.}$$

These values approximate those for the 110 HP Rhone engine, Oberursel copy, which, with d = 113 mm., s = 170 mm., i = 9, hence $v_h = 15.1\ l$, n = 1200 r.p.m. $\epsilon = 5$, gives a net power of 120 HP with a fuel consumption of 305 g/HP-hr.

(f) *Rotary Engine (Siemens-Halske type, high-altitude engine)*

$N_e = 160$ HP, constant to $\mu = 0.7$

$n = 900 + 900 = 1800$ r.p.m.

$\epsilon = 5$, corresponding $\eta_t = 0.43$

$$v_h = \frac{21100 \cdot 160}{0.82 \cdot 0.43 \cdot 0.68 \cdot 1800} \cdot \frac{1}{850 \cdot 0.77} \cdot \frac{1}{0.7} \cdot \frac{1}{0.95} \sim 18.1l$$

$$\eta_w = 0.82 \cdot 0.43 \cdot 0.68 \cdot 0.95 = 0.228$$

$$q = \frac{632}{0.228} = 2770 \text{ HU/HP-hr.}$$

$$b = \frac{2770 \cdot 1000}{10250} = 270 \text{ g/HP-hr.}$$

Here also is good agreement with a similar-powered engine, the 160 HP Siemens-Halske H-SIII, which, with d = 124 mm.,

(*Concluded from page* 187)

INFORMATION FOR PILOTS, GIVING THE PRACTICAL CHARACTERISTICS OF THE LAND ALONG VARIOUS AIR ROUTES

North Carolina

Western part of state quite rough. Central part, good level open country, many large open fields. Soil is mostly loose sand, and although quite good for landing, it makes very slow take-off.

WINSTON-SALEM, N. C., to DANVILLE, Va., hilly, not much chance landing.

DURHAM, field here is very dangerous, stay off.

DURHAM to GREENSBORO, very good country. GREENSBORO to WINSTON-SALEM via HIGH POINT and LEXINGTON, landing fields all through, not so hilly. WINSTON-SALEM to MOUNT AIRY, mountainous land except right near MOUNT AIRY (town).

WEST SALEM to STATESVILLE, fields all the way, hilly. STATESVILLE to TAYLORSVILLE, mountainous, no chance landing. STATESVILLE to CHARLOTTE, hilly, landing possible. CHARLOTTE to GREENVILLE, gets very hilly toward GREENVILLE, not good anywhere.

North Carolina is well adapted for winter flying, but landing fields are scarce in spring and summer, due to the cultivation of crops, mainly cotton and tobacco. That land which is not under cultivation is swamp land or unfit to land upon. A safe landing can be made on plowed ground, but there are chances of a smash-up on the take-off and the damage to crops will be on a large scale. In the winter months landing fields are abundant and flying can be done with ease over this country, although swamp land is extended over a great deal of territory.

Striking south and west from LANGLEY FIELD, Va., across CHESAPEAKE BAY, following the Atlantic Coast Line R. R. through Norfolk and on through Suffolk into North Carolina to RALEIGH, the terrain here is very good; no landing fields at all for about fifty miles. Then one begins to see small plowed fields and pine trees, with only an occasional green field, few of which could be landed in with any degree of safety. Most of North Carolina is like this. Continuing along this route, through TARBORO and ROCKY MOUNT and then the Southern R. R. from WILSON; there are fields at Rocky Mount and Wilson, which have been used for commercial aviation. The eastern part of the state is hopeless. In the central part there are a few landing fields, and two government aerodromes—one is at WINSTON-SALEM; CHARLOTTE and DURHAM and GREENSBORO have commercial fields. RALEIGH is poor territory. The western part of the state is mountainous.

Along the route GREENSBORO to LANGLEY FIELD, Va., through Virginia, conditions are a little better.

North Dakota

Country west of FARGO perfectly level and land almost anywhere. Lots of places to land all around FARGO.

All of North Dakota is especially adapted and offers any number of suitable landing fields in case of forced landings. With the exception of a district in Bottineau County, known as the Turtle Mountains and a small territory in the southwest corner of the state, there is no place where safe landings could not be made with any of the low powered planes used extensively today. During the period when growing grain has obtained its full height just before harvest, the hazard is slightly increased as there is some danger of "Nosing Over" in case of landing in long grass or grain.

North Dakota is one vast prairie in the eastern half of the state, with the same condition prevailing over the western half except that in the latter part there is some land which is very rough, but no machine has ever been heard of crashing due to a mistake in the judgment of a pilot in this part of the country.

North Dakota is a very good state over which to fly. One could possible fly over it at an altitude of three or four thousand feet and set a ship down anywhere on broad level prairie.

North Dakota is an ideal state for flying, flat country with large open fields, not much timber or swamp land, only the north central and southwestern corner is very hilly. Planes operating in North Dakota run the very minimum landing risk.

From FARGO, N. D., to MINNEAPOLIS, Minn., good for first two hundred miles, bad from then on.

FARGO to WILLISTON—fine.

FARGO to GRAND FORKS—fine.

FARGO to WINNIPEG, CAN.—fine.

At FARGO the land is flat and dry, and landing fields are plentiful, at the town itself planes land at the race track.

At GRAND FORKS the land is flat and dry, and there is a splendid landing field at the fair grounds.

At WAMPETON the country is flat and dry, and landing fields are plentiful.

Ohio

From DAYTON to PITTSBURGH, Pa., is a good route until you run into mountainous section.

There is a good landing field at COLUMBUS, Ohio, and the country following the route from the northeast corner to the southwest corner is good all the way through.

Ohio on the average is very good. That portion of Ohio on a line running east to COLUMBUS north is for the most part good flying country.

On the mail route NEW YORK-CLEVELAND, there are few places a pilot could make a forced landing without damage to his ship, although it is not impossible. The mail field at BELLEFONTE, Pa., is bad and the route is hard to pick up. The route—CLEVELAND-CHICAGO, of course, is very good, as it would be possible to pick a safe landing place at any time—route is easy to follow and the mail has a good two way field about half way. MARTIN FIELD at Cleveland is very good for any machine.

INDIANAPOLIS to DAYTON, Ohio, is good. From DAYTON to LOUISVILLE, Ky., is extremely poor, especially after leaving HAMILTON, Ohio. From that place to within about twenty or thirty miles of LOUISVILLE, not even one good landing field can be used in case of motor trouble.

On the CHICAGO - CLEVELAND route, passing over BRYAN, Ohio, the land east from the Illinois line to a point ten miles east of GARY, Ind., is swampy or with a scrub growth or sand dunes, unless swinging around more than five miles south of Lake Michigan. In the balance of the route over Indiana there are short stretches of territory of probably not over ten per cent of the distance altogether on which a dead stick landing without damage would be difficult, but not impossible, due to rolling terrain and numerous groves. In Ohio, in the immediate vicinity of the Maumee River there is quite wet and soft ground during the rainy season. Within a radius of five miles of city limits of CLEVELAND the ground is quite difficult and fields very small. The weather across Indiana, over the lakes region in particular, is quite difficult during rainy seasons, but very rarely impassable, while the weather in Ohio has never been found impassable.

From Johnstown, Pa., through Youngstown, Canton, Akron, Warren and Cleveland, Ohio, country is very good after leaving Pittsburgh, being mostly open and very level.

From SHARON, Pa., to YOUNGSTOWN, Ohio, is fairly good. Thence to PARKERSBURG, W. Va., via MOUNDSVILLE, W. Va., fair for 25 miles out of YOUNGSTOWN until strike Ohio River, then very bad to MOUNDSVILLE.

Oklahoma

ELK CITY, fairly level. CHEYENNE, same, high hills on south. LEEDY, same, level. BEAVER CITY, same, rolling. ANTLERS, rough. WAYNOKA, farm land, rolling, rough on east. GAGE to LAVERNE, rolling pretty choppy. LAVERNE to TYRONE, long rolling, air fair. WAYNOKA to PRATT, Kans., farms, rolling, safe alt. 3,000 feet. TYRONE to GUYMON, nearly level, little rough GUYMON. GUYMON to TEXHOLA, little rough, nearly level, safe alt. 2,000′ GUYMON to LIBERAL, Kans., same.

The northern part of Oklahoma is good. In the eastern part the country is fine as far south as TULSA. From there to the southern boundary the country is nearly all rock hills covered with scrub timber and would be very dangerous for a forced landing. There is an aerodrome at OKMULGEE on this route and a good landing field at COTTONWOOD FALLS. The western route crosses the Wichita Mountains south of OKLAHOMA CITY, but they are not more than 30 miles wide. The rest of the country is good.

North and east of TULSA and OKLAHOMA CITY is good.

From WICHITA and PARSONS, KANSAS, south to TULSA, Okla., is pretty fair flying country. From TULSA to FORT WORTH, Texas, is all good territory.

Most of Oklahoma is good, very little difficulty need be experienced finding landing fields. Pilots should be advised to be very careful regarding weather in all parts of the Pan Handle during the spring of the year on account of high winds which blew many machines away last year, even when well staked to the ground. Also care needs to be exercised regarding sand storms there during those months.

The air in Western Oklahoma is none too good for a novice to work in.

From MONETT, Mo., to TULSA, Okla., 128 miles, has good landing fields all the way, mostly in 260 acre tracts. Gasoline and oil can be gotten at any town on the route. There is a large Curtiss Field at TULSA about 4 miles northwest from the city, and also a Bristol Field 1½ miles from the Curtiss Field. They do repair work and rebuilding. Leaving TULSA going due south for 60 miles, one will reach the Creek County Aeraplane Co.'s Field. The ground between TULSA and OKMULGEE is smooth and one can land anywhere. DALLAS, Texas, is due south from OKMULGEE, Okla., and it is a regular air route, lots of good fields. .

To go to OKLAHOMA CITY from TULSA is 135 miles and the nearest way is to follow the Frisco R. R. tracks; good country all the way and good field west of city at Golf Club.

From ARKANSAS CITY west to WOODWARD, Okla., all country south of this to WACO, Texas, is open and wonderful country to fly over and very flat, with the exception of a little string of mountains that run west from Ft. Sill. These mountains are low and about two miles across in the widest place. All of Oklahoma is good country to fly over with the exception of the southwest part of the state, which has quite a bit of timber.

Pennsylvania

PITTSBURGH and vicinity, good landing fields are scarce. One should avoid the country east of PITTSBURGH. There are one or two good landing fields around here.

Central Pennsylvania is practically all mountains, poor flying territory between PHILADELPHIA and HARRISBURG. Following the P. R.R. lines through Coatesville, Lancashire to Harrisburg, very safe route, conditions of the ground, mostly flat, cultivated fields, numerous good landing places. From HARRISBURG north to SUNBURY, country very mountainous. It is dangerous territory to fly over, very bumpy in the air and the valleys are so rolling that they present poor fields in which to land. When flying from HARRISBURG to SUNBURY follow Susquehanna River, keep an altitude of 5,000′ and the landing field will always be within gliding distance. Cultivated islands in the river are good to land on.

At Clarks Ferry, Millersburg, Selinsgrove Junction and Sunbury pilots flying along the Susquehanna River should be warned that at MILLERSBURG, some 20 miles north of HARRISBURG, there are four wide cables stretched across the river between the mountains at opposite sides, mountains 2 000′ high; cable starts from peaks, sags in centre to above 50 feet of water in river like Lykens Valley, in which is situated towns of Williamtown, Lykens and Wiconisco. Dangerous valley for flying, being nearly closed in at both ends makes air practically dead. Only experienced pilots should risk landing in this valley. From CLARKS FERRY to LEWISTOWN, country very rolling and mountainous. No fair landing places until TOMPSONTOWN is reached. BLOOMSBURG and BERWICK, good landing territory. At SUNBURY, mail pilots often land on large flat island in center of river. Farmers object to planes landing here.

The western part of Pennsylvania is not good flying country. There is very poor flying country over the following counties: Warren, McKean, Elk, Potter, Cameron, Jefferson, Clearfield, Clinton, Lycoming, Tioga, Cambria, Indiana Counties. This part of the state is not swampy, but it is hilly and in places rocky. It is not the kind of country that a pilot can feel at ease in while flying over.

The condition of the land in Pennsylvania west and north of WILKES-BARRE to the borders of Ohio and New York State respectively, hills and mountains in this section are very numerous, but a pilot on a cross-country flight over this territory can find a landing field in any valley in case of trouble if at a safe height.

Route from PHILADELPHIA to PITTSBURGH:

Leaving PHILADELPHIA, following the P. R.R. to LANCASTER, there are many forced landing fields, country comparatively level. Aviation field northeast of LANCASTER good two-way field.

Leaving LANCASTER to HARRISBURG, following P. R.R., level country. Landing field at southern city limits, near railroad.

Leaving HARRISBURG, taking southerly course over and following the CUMBERLAND VALLEY, landing at MERCERSBURG, having all level country from HARRISBURG to WEST MERCERSBURG. Land at small field at southwest city limits.

Leaving MERCERSBURG to west for PITTSBURGH, go one mile north over LINCOLN HIGHWAY, turning and following it all the way, landing field at LIGONIER, near small lake, one at IRWIN on left of Highway one mile east of IRWIN, then to PITTSBURGH, landing in SCHENLEY PARK.

The route from MERCERSBURG to PITTSBURGH is rather a hazardous trip unless one is near the fields mentioned, as the country is very mountainous and positively no landing fields.

In the INDIANA COUNTY territory there is no risk, as there are many fields that can answer for landings.

The mail field at BELLEFONTE is bad and the route is hard to pick up.

ATLANTIC CITY via PHILADELPHIA to LANCASTER, PA. Fairly good country. Good field at point near PHILADELPHIA. Country affords open fields and farm lands en route and lots good fields near LANCASTER. One field fairly good right in the city—F. & M. College grounds.

LANCASTER to YORK, PA., open fields and good country. YORK to HAGERSTOWN, MD., O.K. part of the way, but approaches Alleghany Ranges and rapidly becomes worse until it is really unfit for flying unless motor is sure. Thence to JOHNSTOWN, very bad, only one field there fairly good. Thence to PITTSBURGH, very dangerous. Thence to YOUNGSTOWN, CANTON, AKRON, WARREN and CLEVELAND, Ohio, country very good after leaving PITTSBURGH, being mostly open and very level. NEWCASTLE, Pa., fairly good.

NEW YORK CITY starting from ROOSEVELT FIELD, L. I., rather poor in event of forced landings, growing worse around vicinity of DELAWARE WATER GAP and bad approaching SCRANTON, PA. Heading towards ELMIRA, N. Y., rather better than before, but still far from good, although there are fields for forced landings at WYALUSING and TONAWANDA. Fairly good country near ELMIRA. Lots of good fields a few miles west. Thence to OLEAN rather poorer country, not so many fields. Thence to WARREN, PA., growing worse all the time. Poor chance here. Thence to SHARON, PA. via FRANKLIN and OIL CITY. Bad territory; forced to stick to river valley; river only place to land. One field near FRANKLIN up on high hill.

SHARON to YOUNGSTOWN, OHIO, fairly good.

BUFFALO, N. Y. to ERIE, PA., very good all along LAKE ERIE and good fields at ERIE. Thence to SHARON, PA., very fair open fields.

Rhode Island

Country around WESTERLY, R. I., within a radius of 10 to 12 miles is very rocky, with many uneven landing fields. A landing can be made, but one should be very careful in choosing the field.

From PROVIDENCE to BOSTON, one can follow fairly good country, evenly sprinkled with landing fields, but few should be used except in case of an emergency. The Aviation Field of Rhode Island at PROVIDENCE is an excellent field.

Across Mass. from SPRINGFIELD to WOONSOCKET, R. I., from an altitude of 7000′ to 8000′ a field fit to land in was not observed. All woods and hills.

To the south of WOONSOCKET there is one fair field, and flying north from there to LOWELL, MASS. and out the Merrimac River to NEWBURYPORT, MASS., there are plenty of suitable landing fields.

South Carolina

COLUMBIA to AUGUSTA, GA., good fields first 60 miles, no fields last 15. COLUMBIA to BENNETTSVILLE, good fields all the way except around CHEROW.

GREENVILLE to COLUMBIA, no fields till within 20 miles of COLUMBIA, then plenty of pasture near ricer. COLUMBIA to BARNWELL, good country last mostly anywhere. BARNWELL to SUMTER, good country, land anywhere except from PEEDEE SWAMP, 4 miles wide. SUMTER to FLORENCE, good country, land mostly anywhere. BARNWELL to PARIS ISLAND, forced landings possible, as well as in YEMASSEE, almost impossible between YEMASSEE and PARIS ISLAND, very deceptive as tide goes out and leaves very soft marshes that appear to be very beautiful pastures from the air.

COLUMBIA to WINSTON-SALEM, N. C., very poor country, lucky if landing can be made without damage anywhere, very hilly.

Flying in the immediate vicinity of DARLINGTON is not hazardous, but rather inconvenient, owing to scarcity of suitable landing fields. On the border of DARLINGTON and MARLBORO COUNTIES there is a river-swamp to the northwest that necessitates plenty of altitude in crossing, and the same holds true of the southwestern border of SUMTER COUNTY, but aside from those there are no natural difficulties to overcome.

From MONTGOMERY, ALA. there are landing places to be found at COLUMBUS, GA., MACON, GA., AUGUSTA, GA., COLUMBIA, S. C., SUMTER, S. C. and DARLINGTON, S. C.

South Carolina is well adapted for winter flying, but landing fields are scarce in spring and summer, due to the cultivation of crops, mainly cotton and tobacco. That land which is not under cultivation is swamp land or unfit to land upon. A safe landing can be made on plowed ground, but there are chances of a smash-up on the take-off and the damage to crops will be on a large scale. In the winter months landing fields are abundant and flying can be done with ease over this country, although swamp land is extended over a great deal of territory.

NAVAL and MILITARY AERONAUTICS

Commander Towers to Pensacola

Commander John H. Towers will arrive in Pensacola about the first of November, having been ordered by the navy department to the Pensacola Naval Air Station as executive officer, succeeding Lieutenant-Commander Paunac in that capacity. Commander Towers is now with the Pacific Fleet Air Squadron.

No official statement has been received from Washington as to the orders received by Lt-Com. Paunac, but it is stated unofficially that he will probably assume other duties at the naval air station.

Commander Towers was the first American aviator to make an official flight for the United States government, he having been sent to Vera Cruz to make maps of that country at the time of the trouble between Vera Cruz and the United States.

Later he was sent to England and it was while at the court of St. James that he met his wife, who is of English nobility. The wedding of Commander Towers to this daughter of an English Lord was an event of the season at Mayfair; and was widely chronicled.

Commander Towers received much of his training in England and he was the first head of the naval air training school at the time that Captain Mustin was in command at the station on its organization in 1914. After his training here he was much abroad and was one of the naval aviators to compete with Lt-Commander Albert Cushing Read and P. N. L. Bellinger in the first long distance flight across the Atlantic, which was won by Read.

In spite of his high social connections and the fact that he ranks as one of the greatest of aviators, Commander Towers is "Jack" Towers to the Pensacola friends he made during his residence, and old friends as well as officers of the navy and army will cordially welcome him to Pensacola.

Naval Air Stations on Peace Basis

Washington.—Organization of the naval air establishments on the Pacific coast on a peace basis has been undertaken by the navy department, with the transfer to San Diego of much of the equipment and personnel formerly stationed at Cape May, N. J., Chatham, Mass., and Rockaway, N. Y.

Strategic considerations led to concentration of most of the navy's air forces on the Atlantic seaboard during the war, officials said, but with the end of hostilities this necessity was removed. The three eastern stations recently closed because of lack of adequate operating funds.

Following the basic naval policy the intention of the department is to divide its aviation facilities equally between the two coasts.

The navy has five practical branches to its air service, two air fleet forces, one operating with each fleet; aid force bases at Hampton Roads and San Diego, where the machines are repaired and supplied and the men trained; two territorial patrol stations at Coco Solo, Panama, and Pearl Harbor, Hawaii; a general training station at Pensacola, Florida, and an experimental station for the development of rigids at Lakehurst, N. J., which, however, is not an operating station.

The flying personnel of the navy now numbers approximately 6,065 pilots.

XBIA Aeroplanes to be Operated

The Commanding Officer of the San Antonio Air Intermediate Depot has received orders to set up immediately ten XBIA aeroplanes, which will be assigned to a squadron at Kelly Field to be designated by the Comanding General of the 8th Corps Area. This being the first time that this equipment is to be operated in the Air Service, special pains will be taken to see that the necessary detailed reports are secured, in order that an accurate historical record may be obtained and such other information gathered as may be of value to the Engineering Devision at McCook Field in the development of future equipment. Cross-country flights in this aeroplane will be prohibited until the necessary testing about the aerodrome has proven satisfactory.

The Blimp as an Observation Balloon

At the Army Balloon School at Ross Field, Arcadia, California, a second test was recently made of using a Pony Blimp as an observation balloon by means of attaching a cable. The Blimp was allowed to rise to a height of 1,000 feet and showed marked improvement over the initial trial as an observation balloon. The test clearly indicated that the motorized observation balloon has great possibilities. It is believed by many airship pilots that the Blimp will soon supplant the observation balloon, as it will be able to remain stationary over a given point by means of a cable. When it is desired to change position this may be done by hauling in the cable and flying to another point. Further tests will be made in the near future.

Completion of Flying Training at Post Field

What is perhaps the most thorough course of flying training yet accorded any class of student flyers in the history of the United States Air Service terminated at Post Field on Thursday, September 15th, when the summer term of the Air Service Observation School, which commenced on April 25th last, was brought to a close, with a total of 42 flying officer graduates, all of whom were at once reported to the academic board convened at this station as ready to be recommeneded for rating as aeroplane pilots. Eight field officers are included in the list of graduates.

Including time in the air as observers on practice tactical missions, the pilot books of the officers graduated show an average total of approximately 130 hours flying time which, when distributed over a period of but little over five months, gives a clearer idea of the amount of flying required of each student to complete the curriculum of advanced flying training at this school. The above figure is, of course, exclusive of flying time accumulated at primary Air Service schools, which will average about 70 hours for each pilot, giving a grand total of approximately 200 hours in the air before the student flyer was considered ready for the much coveted rating of aeroplane pilot.

A comparative value of the above figures, which helps to indicate that the ideal of peace time air training is thoroughness, may be obtained when it is remembered that, under the stress of war requirements, many pilots were operating successfully on the Western Front before they had gained a total air experience of as much as 50 hours, and in many cases, particularly in the Royal Air Force, 30 hours or even less would cover the total instruction and practice time of flying officers prior to their first trip over the lines, whilst the average useful life of a pilot in actual war service missions on the Western Front, measured in hours of flying time in contact with the enemy, was computed as considerably less than 100 hours.

Ten hours of formation practice in DeHaviland 4 Liberty machines was made a part of the advanced training curriculum for each pilot of the present class at Post Field, and a further idea of the thoroughness of practical flying experience gained by each of the present graduates before being reported as ready for rating is gained from the fact that the cross country training of the class as a whole involved a grand total of approximately 127,000 miles which, divided among the class of 42 student flyers, gives an average of over 3,000 miles for each pilot on cross country flying alone, all of which was carried out during the final month of the course. Several organized cross country flights, with formations in some instances including up to 15 machines, were flown by student officers to destinations varying in distance of from 200 to nearly 500 miles.

The numerous individual cross country missions involved were in almost every instance thoroughly successful, and served to demonstrate in the most practical way the ability of the student to navigate his course under all conditions of weather and varying terrain, operate from unfamiliar and often quite unfavorable fields, and to exercise practical resourcefulness in the care and repair of both ship and motor without assistance from the home station.

Meteorological Station at Carlstrom Field

The Signal Corps is establishing a meteorological station at Carlstrom Field, and Sergeant John M. McClelland has been sent to this station to have charge of this work. The various instruments and implements are already on hand and are being set up under Sergeant McClelland's direction. The station is located at the Old North Gate, and the guard house there is being used in connection with the work.

FOREIGN NEWS

An Air Ambulance

Recently one of the Continental air expresses was converted into an ambulance for a woman patient traveling with a nurse from London to Paris to undergo an urgent operation. The woman, after being taken to the air station in a motor car, was carried in an invalid chair and lifted into the saloon of the aeroplane, which had been specially prepared for her.

Ringing Up a Plane

The entire British fleet of air expresses in regular use between London and Paris is now equipped with wireless telephones, and during their aerial journeys the machines are in constant communication with the ground stations.

It is no uncommon thing to hear while "listening in" at a ground station the pilot of an incoming air express speaking to the pilot of an outgoing machine and advising him of peculiarities of the weather along the route. The enterprise of British air transport firms in this matter is illustrated by the fact that foreign machines using the London air port, although outnumbering the British by nearly 2 to 1, do not use wireless. In fact, on only one foreign machine has any attempt been made to provide this necessary facility.

Appropriations by Italian Government for Civil and Military Aviation

For the fiscal year ending June 30, 1922, the Italian Government has appropriated 42,700,000 lire for the Army Air Service and 22,060,000 lire for Civil Air Service, both services being under the jurisdiction of the War Department.

With regard to the appropriation for military aviation, the largest sum is allotted for the renewal of aviation material (16,500,000 lire). Next in order is 13,000,000 lire for gasoline, oils, etc. For expenses incidental to the preparation of flying personnel 4,800,000 lire is allotted; maintenance of buildings and aerodromes 2,200,000 lire; special compensation to flying personnel, 2,400,000 lire; conducting experiments of aircraft and aircraft armament, 2,050,000 lire; repair and maintenance of planes, motors, and other material, 1,300,000 lire; aerial photography, 150,000 lire; and miscellaneous expenditures, 300,000 lire.

Of the appropriation for civil aviation, 4,500,000 lire is allotted as subsidies to private aeronautical concerns for the operation of airdromes and aerial routes by heavier-than-air and lighter-than-air craft; 2,300,000 lire for carrying out studies and experiments; 3,000,000 lire for construction purposes; 2,460,000 lire for the operation of a preliminary flying school; and the remaining 7,200,000 for miscellaneous purposes. An additional appropriation, not yet determined, is to be allowed the Civil Air Service for the construction of commercial aeroplanes.

The salaries of army personnel are paid out of other appropriations for the support of the Army. Many of the aerodromes are also supported from funds appropriated for the maintenance of army posts. It is estimated that the Army and Civil Air Services receive from other appropriations to cover various services such as maintenance of posts, pay of the army, etc., 50,000,000 lire, making a total sum to be expended for military and commercial aviation in Italy during this fiscal year of approximately 112,760,000 lire, or slightly over $28,000,000.

Altitude Record by Uruguayan Officer

A dispatch from Uruguay is to the effect that the Uruguayan military aviator, Captain Larre Borges, with two passengers, attained an altitude of 6,700 metres (21,981 feet), being forced to descend from that height because of lack of oxygen.

S.V.A.'s in Ecuador

Two S.V.A. 130 horsepower planes with a speed of 140 kilometers have been imported from Italy and presented to the Ecuadorian Government by the University Patriotic Club and the Syrian Colony. There are now seven planes in the government service and one more is promised by the Chinese Colony. The National Government has contracted with an Italian manufacturer to furnish 12 aeroplanes with the equipment for repair shops. The Bank of Ecuador and the Commercial and Agricultural Bank have each contributed 15,000 sucres toward the Government aviation field across the river from Guayaquil. The total subscription for the field exceeds 50,000 sucres (approximately $25,000).

Touring Europe by Air

The following brief account of the tour of Europe made by a machine hired from the de Haviland Hire Department, which appears in *Flight*, is of considerable interest, not only on account of a very good performance, but equally because of the information concerning the various landing grounds, etc., of which the travelers had experience. When it is remembered that the total distance covered was about 4,500 miles, and that not a wire was broken or a mishap of any kind occurred, this brief and modest account by the pilot, Mr. A. J. Cobham, throws a strong light on the reliability of modern air travel.

This trip was carried out on a standard D.H. 9 four-seater machine (piloted by Mr. A. J. Cohham) hired by two business men as the best and cheapest method of visiting the principal towns of Europe. In all 17 towns were visited and 4.500 miles covered in three weeks, or 56 hours' flying time, the program being so arranged that the flying was usually done between lunch and dinner, leaving the evenings free for social engagements and the mornings for business purposes. On a journey of this magnitude many interesting and amusing episodes naturally occurred, but it has been thought best to confine this account to an itinerary of the ground covered, with such details added as are likely to be of use to those covering the same ground, or which are of general aeronautical interest.

August 24.—Stag Lane-Lympne, 80 *miles. Time,* 1 *hr.*

It was impossible to get further that day, owing to dense fog in the Channel.

August 25.—Lympne-Paris, 170 *miles. Time,* 2 *hrs.*

August 26.—Paris-Brussels, 170 *miles. Time,* 2 *hrs.* 5 *mins. Brussels-Amsterdam,* 120 *miles. Time,* 1 *hr.* 20 *mins.*

At Brussels the Aerodrome is just north-east of the town, and quite close in. The approach is good, but the surface poor. The Amsterdam Aerodrome is good, with plenty of accommodation and a first-class hotel. The K.L.M. Co. are evidently anticipating some big business, and are ably assisted by the Dutch Government, which has even given them a plot of land in the center of the town to erect a booking office.

August 27.—Amsterdam-Bremen, 180 *miles. Time,* 2 *hrs.* 30 *mins.*
Bremen-Hamburg, 70 *miles. Time,* 1 *hr.*

The stop at Bremen was for customs only. At Hamburg the landing ground is the old Zeppelin Aerodrome. The surface is bad at present, but the authorities talk of making this the finest aerodrome in Germany when the program they have in contemplation materializes. The only petrol obtainable was of poor quality, and the engine revs. suffered in consequence.

August 28.—Hamburg-Copenhagen, 200 *miles. Time,* 2 *hrs.* 30 *mins.*

Here the aerodrome is right in the center of the town, but unfortunately there is a prospect of it being changed, as the present site is required for building purposes. By reason of its position as the Scandinavian link with the Continent, Copenhagen should become a big commercial aviation center connecting both Stockholm and Christiania with Hamburg and Rotterdam, and thence by sea or air with London.

September 1.—Copenhagen-Stockholm, 350 *miles. Time,* 3 *hrs.* 55 *mins.*

Three days were spent in Copenhagen, and then the journey was resumed to Stockholm. Owing to the hilly and mountainous nature of this region, it is very difficult flying country, though extremely picturesque seen from above. The first half of the journey offers no possible landing place, but after that, the lakes would afford a landing place for seaplanes, or in winter, when they are frozen over, to aeroplanes fitted with skiis. At Stockholm a landing was made at Hagerstahand Aerodrome, about 15 km. north-west of the town. No accommodation exists at present, and the surface is not very good, but work is in hand to put this right.

September 3.—Stockholm-Orebro, 110 *miles. Time,* 1 *hr.* 45 *mins.*
Orebro—Christiania, 180 *miles. Time,* 2 *hrs.* 20 *mins.*

The next stage was to Christiania, but *en route* a stop was made at Orebro, where Capt. Saunders, who has been flying in Sweden for the last two years, was giving an exhibition on an Avro. After a short stay the journey was continued against a strong head wind, following the railway track to Manger, and thence on a compass course due west to Keller, over a mountainous trackless waste, with no possibility of landing, and no sign of any habitation. The landing was made at Keller Military Aerodrome, in the heart of the hills. This Aerodrome is quite large and level, but the surface is a bit heavy.

September 4.—Christiania-Copenhagen, 350 *miles. Time,* 3 *hrs.* 40 *mins.*

From Christiania to Gottenburg there are no landing grounds, but at the latter place what looks to be a fairly good landing ground exists. A landing was made in a field at Helsingborg owing to low cloud, storm and rain, but after a 50-min. wait, conditions improved sufficiently to enable the flight to be continued over the sea to Copenhagen at about 50 ft. above the water.

September 5.—Copenhagen-Berlin, 240 *miles. Time,* 3 *hrs.* 20 *mins.*

The short sea route, *via* Schwerin, was followed, and a landing made at the Aerodrome (now quite good) due west of Berlin in the fork of the main lines. Every courtesy was extended by the aviation authorities, but the only petrol obtainable was very poor and heavy, and again the engine revs. suffered.

September 7.—Berlin-Warsaw, 350 *miles. Time,* 3 *hrs.* 40 *mins.*

The Aerodrome at Warsaw is good and close to the town, but as no sort of accommodation was procurable, the party had to spend the night in the Turkish Baths! Here a delay occurred in the resumption of the flight owing to the Aerodrome Commandant being *en fête,* and until his return on the next morning the machine was not allowed to proceed, being guarded meanwhile by a cordon of Polish troops.

September 9.—Warsaw-Prague, 350 *miles. Time,* 3 *hrs.* 40 *mins.*

The Aerodrome at Prague is both military and civil, and every accommodation exists, and all help was gladly given.

September 10.—Prague-Vienna, 180 *miles. Time,* 2 *hrs.* 40 *mins.*

The Aerodrome at Vienna is good, but runs in ridges from north to south. The travelers were very well treated, but found the petrol dirty and mixed with water.

September 11.—Vienna-Klagenfurt, 140 *miles. Time,* 2 *hrs.*

Owing to the Austria-Hungary hostilities it was decided to go to Venice not *via* Gratz, but down the valley to Klagenfurt. This involved flying down a narrow valley at a height of 5,000 ft. with mountains towering 8,000 ft. above. As soon after leaving Vienna, one magneto cut out, it was decided to land at Klagenfurt. The Aerodrome is quite good and very large, with a fair surface except near the hangars.

September 12.—Klagenfurt-Venice, 160 *miles. Time,* 2 *hrs.* 20 *mins.*

As the Aerodrome at Klagenfurt is 2,000 ft. above sea level, the start planned for 11 a. m. had to be postponed till the afternoon, with a load of 600 lbs., plus pilot and fuel, the machine would not unstick. The flight onward embraced several very narrow valleys, with the clouds at times so low overhead as to give one the impression of flying down a tunnel. The landing was made at the Lido Military Aerodrome, near Venice, where every courtesy was received from the Italian officers.

September 13.—Venice-Brescia. 100 *miles. Time,* 1 *hr.* 20 *mins.*

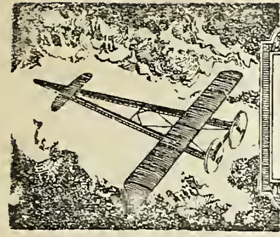
No petrol being procurable in Venice, an Italian officer kindly volunteered to accompany the machine to Brescia, in order that there should be no difficulties with the authorities. This meant increasing the load of the machine by another 150 lbs., but with the help of a steep concrete gradient, the get-off was effected. The machine landed at the Ghedi Aerodrome, and it being too late to continue that evening, the Italian officers did their best to entertain the travelers. So well did they succeed that the only untoward incident of the trip occurred, a most enjoyable motor-car drive by moonlight, culminating in the whole party being upset in a ditch at 50 m.p.h., fortunately without serious accident.

September 14.—Brescia-Milan, 60 *miles. Time,* 50 *mins.*
Milan-Nimes, 280 *miles. Time,* 4 *hrs.* 20 *mins.*

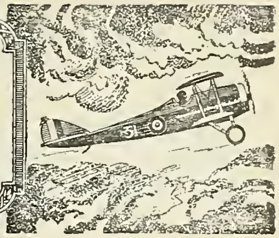
The route followed was *via* Genoa and then along the Mediterranean to Nice, so that the full beauty of this coast was seen. Between Genoa and Nice there is hardly any possible landing ground. There are two or three spots where one might get down, but not off again. The Aerodrome at Nimes is quite good, but a sharp lookout must be kept for pupils from the flying school on solo flights.

September 15.—Nimes-Paris, 390 *miles. Time,* 4 *hrs.* 40 *mins.*
September 16.—Paris-Stag Lane, 270 *miles. Time,* 3 *hrs.*

This completed what is probably the longest business trip by air yet undertaken.



ELEMENTARY AERONAUTICS and MODEL NOTES



Mummert Sport Plane Flown at Curtiss Field

ONE of the most interesting aeroplanes exhibited at the Aero Club's "Field Day" at Curtiss Field on October 16th was the little Mummert Sport Plane described in these columns recently. During the day the machine was parked out among the bigger planes, where its remarkable contrast in size, especially when the big Remmington-Buranelli 30-passenger plane was near, caused much speculation on the part of strangers who wondered if it could really fly.

It was not until just before dark that Bert Acosta had the opportunity to take the Mummert plane up; Acosta had been flying continuously all day, mostly the old 1910 Curtiss pusher exhibition plane and the new Fokker monoplane which carries six passengers. Mr. Mummert was on hand to tune his machine up, and the engine was working satisfactorily.

After removing his boots, to the wonderment and laughter of the crowd which closed in around the plane, Acosta slid into the fuselage. A good deal of persuasion was necessary to clear the way for the machine to take off, so eager was the crowd to carefully observe the preparations for flight. As the engine is an air-cooled type (Lawrence 2-cylinder) no "warming-up" was necessary, and after a few minutes to make sure it was functioning properly, the plane taxied off, gathered speed and took off in the finest form. A couple of circles were made of the field, the machine exhibiting perfect control and unusual speed. The speed appeared to observers to be between 90 and 100 miles an hour, and the altitude about 500 feet.

In landing, the machine soared in a flat glide for quite a distance before the wheels touched. The machine turned and taxied back to the starting point. By that time it was growing dark and the flames from the exhaust ports of the engine were visible even before the machine could be discerned as it approached the waiting crowd. The spectators seemed satisfied to regard this flight as a fitting conclusion to one of the finest "Aerial Field Days" New York has witnessed in years.

Impromptu Reunion of Model Flyers

The flying exhibition at Curtiss Field on October 16th proved to be an attraction for a great number of young men who formerly belonged to Model clubs in and near New York. Many of the old model flyers who were ardent followers of the sport many years ago met and renewed acquaintances. A good many of the former model flyers are now engaged in various branches of the aircraft business, as pilots, designers, mechanicians, etc.

The Laird "Swallow," a 3-passenger plane which was flown from Kansas, was piloted by "Buck" Weaver, one of the most popular of the "old" model enthusiasts. His clever flying was a treat, for he has all the tricks of the trade and knows how to behave in the air. John Carisi, associate with Buranelli in the construction of the "A.B.C." pusher, flown by Bjorkland in the pre-war days, was a skillful builder of models, as was Vincent J. Buranelli, his former partner. Carisi and Buranelli were also with Lawson when the "Air Liners" were produced. Carisi is at present with the Wittemann-Lewis Co.

Vincent Buranelli was chief designer for the Nebraska Aircraft Co., designed the Continental Pusher at Capague, L. I., and recently designed the Remmington-Buranelli 30 passenger machine. He made several flights during the day.

Some of the other model flyers who were met on the field were: Russell Holdermann, pilot; George A. Page, formerly pilot for the Trans-Oceanic Co.'s twin-motored boat called "The Big Fish," which plys between Florida and Cuba during the winter, now in the aircraft department of the Ordnance Engineering Corporation; Louis Fenouillet, mechanician; Rudolph Funk, designer, now with the Lawrence Sperry Co.; George F. McLaughlin, designer, Ordnance Engineering Corporation; Andrew Surini, mechanician—"one of the few who can swing the propeller of a Liberty Engine"; Frank Shober, now with Cox-Klemins, and known for his compressed-air engines. Shober has been regarded as one of the neatest model-builders, being able to carry out the greatest of detail and finest finish on every model he built. He has many records to his credit. Lee Wallace, an early pilot and designer, is well known among the members of the old New York Aero Science Club and the Aeronautical Society. Walter H. Phipps, of the Ordnance Engineering Corporation, is another ex-member of the Aero Science Club. Although he has designed a number of successful planes (the latest being the "Orenco" Type F-4, 4-passenger plane which is just completed) in the many years he has been active in the game, his interest in models continues. Broadfield Billings, an expert model flyer at Van Cortlandt Park years ago and now a professional designer of models, and inventor of the "Broadfield" line of model aeroplanes. Other model flyers, whose names cannot at this moment be recalled, appeared and talked over old times.

Some of the newer model flyers, whose names are familiar to AERIAL AGE readers, are W. F. Shult (whose hydro-model was described last February), now with "Orenco"; and Bruce A. Mapes, whose many fine models are admired by readers of the Elementary Aeronautics Page.

Page and Fenouillet made flights with Weaver. Buranelli flew with Eddie Stinson in the Remmington-Buranelli plane. Funk and Phipps flew in the Sperry monoplane. Mr. Dickenson, who is 78 years "young," accompanied Weaver in his flight from the West. Mr. Dickenson is a member of the Illinois Model Aero Club, having given the club his valued support and assistance in many ways. Incidentally, Mr. Dickenson is one of the oldest pilots in the country and capable of handling a plane without the least difficulty.

S. E. V. Model Built by W. G. Eldridge, Jr.

Below is shown a nicely proportioned scale model of the S. E. V. Scout biplane, made by Willard G. Eldridge, Jr., of Washington, D. C. This model was constructed to plans published in AERIAL AGE on July 8th, 1918, and the drawings published on the model page November 29th, 1920.

Care was taken to make this model as nearly correct in all details to make an accurate reproduction of the S. E. V. as used by the British and American air forces during the war.

The fuselage is made of veneer and built up of wood members in a manner similar to the real machine; that is, veneer extends from the radiator to the pilot's cockpit. The rear of the body is covered with bamboo paper. A radiator is mounted in front, with shutters. The imitation Hispano engine is cowled over with aluminum hoods. A machine gun is mounted on the top wing.

One gross (144) wood screws were used to attach fittings, making the machine rather heavy for flying, although it glides perfectly.

Mr. Eldridge will be glad to hear from any fellow engaged in building models or one interested in the discussion of aeronautics. Address, 542 Irving Street, N. W., Washington, D.C.

SE-V Scout Model with a 39-inch wing span. Built by Willard G. Eldridge, Jr., from Aerial Age plan

A-E-R-O-N-I-T-I-S

The Air Racing

(With apologies to Mr. Kipling.)
When the last of the races is ended,
And the tanks are all emptied and dried;
When the cuts and the bruises have mended,
And the serious cases have died—
We shall rest, and faith, we shall need it—
Do nought for a month or two,
Till the people—seeking amusement—
Shall put us to race anew.

And the pilots that win shall be happy
For, passing the Judges' tent,
They shall spin and roll and side-slip,
And loop to their hearts' content;
They can do as they like for the moment;
They can glide or crash or fall;
Or can turn their noses upwards,
And never come down at all.

And most of the people will praise them,
Though some of the people will blame,
Saying they do it for money,
Saying they do it for fame.
Yet—each for the joy of the flying,
And each in his separate way,
Will put all his best in his racing
To make a success of the day.

—*J. M. Q. in The Aeroplane.*

On High

By Contact.

To John A. Macready, Holder of World's Altitude Record.

With a steady deepened roar,
Louder yet becomes the sound,
Over the smooth and earthy floor
The man-bird speeds and leaves the ground.

Up, up farther he flew,
'Til lost completely from our sight,
Far in the sea of fathomless blue
He cruised fair skies at an unknown height.

The "Liberty" with its faithful song
Resounds and echoes thruout the sky,
Carrying plane and pilot swiftly along,
To uncharted ways on high.

Up, 'til no further can he go,
So down he glides in open space,
Down to the welcome ground below,
To greet the earth's bright shining face.

Coasting down from where he came,
Down from his greatest height,
To add more honor to his name,
On this record-breaking flight.

So will man strive to conquer the sky,
Intrepid men with frail linen wings,
Will soar with wingèd steeds on high,
To rise above the lower things.

The Economics prof. was waxing warm on the topic of Supply and Demand. Singling out an unappreciative, he asked: "Mr. Dash, give me an example of an elastic demand."
Mr. Sprint—"A pair of garters."

—*Orange Peel.*

"Why was Miss Calculation sent home from college?"
"She went with too many men to the shows."
"What of that?"
"She was making fraudulent use of the males."

From Our Cynical Bachelor

An evening spent at a mixed bridge party makes a man appreciate the poker session at the club.

The fellow that forgets to get up for graduation will probably go to sleep at his own wedding.

Can it be possible that the predominance of bobbed hair is due to a cheapness of upkeep.

The beauty spot has caused the loss of more heads than the guillotine. —*Wisconsin Octopus.*

A Romance

He saw her on the campus
And liked the way she walked.
He spoke to her on the side walk
And liked the way she talked,
He tried her at a party
And liked the way she danced.
He took her out to dinner
And came away entranced.
He went to church on Sunday
And listened to her sing.
He took her for a car ride
And how that girl did ——,
Well anyway he liked her
And she grew fond of him
And now beneath her ? ? ?
She wears his ? pin.

"So the doctor told you to go to a warmer climate. What was the nature of the trouble you consulted him about?"
"I went there to collect a bill."—*Michigan Public Health.*

First Stenog. (reading)—"Think of those Spaniards going 3000 miles on a galleon!"
Second Stenog.—"Aw. forget it. Yuh can't believe all yuh hear about them foreign cars."—*N. Y. American.*

The Regulation Blues

Before I joined my hair was long
And was my pride and joy;
In fact, the girls would stroke my locks
And call me "pretty boy."

They simply made a fool of me,
And I had lots of fun,
Now if they see me coming,
Those same girls start to run.

Or tell me I may wear my hat;
Some even say "good night!"
"Where did you get that hair-cut?
You surely are a sight."

And then they count my knowledge bumps,
Dog-gone, but I get blue!
And say it's regulation—
That's all a gob can do.

—*A. R. D.*

"I had a swell bun on last night."
"Lucky stiff! How'd you get the hooch?"
"Won five prescriptions in a poker game."

Keep Moving

Some visitors were standing in a Glasgow street, gazing at certain points of interest.

"Come now," said a policeman, "move on there. You're blocking up the path."

"I thought this was a free country," said one of the party.

"Aye, but ye're in the toon the noo," replied the policeman, "and if ye'll be wanting to be standing there, ye must be walking aboot!"—*London Ideas.*

The Poet

I loathe him.
I am a beautiful woman . . .
The title of the love sonnet was: "Lines on Eleanor's Face."—*Black and Blue Jay.*

Klauder—"I almost married a shimmie dancer."
Kafka—"What then prevented the marriage?"
Klauder—"Oh, she just wiggled out of it."

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Map Reading for Aviators

This concise book by C. B. Benson, C. E., formerly instructor in Cornell University School of Military Aeronautics, is one which every pilot should have. It discusses maps, map scales, conventional signs, form of the ground, direction, and preparation of maps. There is also an interesting chapter on aerial navigation. Price, postpaid, **60 cents.**

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(*Concluded from page* 176)

that will be made in the future by aircraft, on May 10th, 1921, The World's Board of Aeronautical Commissioners, Inc., mailed from their New York office four letters as follows:

A—Westward, via New Zealand and England.
B—Westward, via Japan, Ceylon and England.
C—Eastward, via England and New Zealand.
D—Eastward, via England, Ceylon and Japan.

The letters were remailed by the Commissioners of the Board, the Hon. Sir R. Heaton Rhoades in New Zealand, the Hon. B. F. Leefe in Ceylon, Sir George Fisher-Smith in England and Mr. E. W. Frazar in Japan.

	Days	*Hours*
The Eastward letter "D" via England, Ceylon and Japan arrived in New York, October 17th, 1921, but the remailing was delayed in Ceylon, owing to the absence of the Commissioner, 71 days. Deducting this delay and the journey would have been made in	89	2136
The two Westward letters (A-B) arrived in New York same time	104	2496
The second letter Eastward, via Japan, Ceylon and England required	111	2664
Estimated time required by aircraft to make a flight around the world via Alaska, Aleutian Islands, Japan, China, Burma, India, Persia, Greece, Italy, England and Newfoundland (22,207 miles)	300	

A—Westward via New Zealand and England.

Mailed		*Arrived*	*Date*
New York	May 10	Wellington, N. Z.	July 16
Wellington, N. Z.	July 16	Halifax, England	Aug. 10
Halifax, England	Aug 10	New York	Aug. 22

Time—Days, 104; *Hours,* 2496.

B—Westward via Japan, Ceylon and England.

Mailed	*Date*	*Arrived*	*Date*
New York	May 10	Tokyo, Japan	June 10
Tokyo, Japan	June 10	Colombo, Ceylon	July 8
Colombo, Ceylon	July 9	Halifax, England	Aug. 6
Halifax, England (No mail Sunday)	Aug 8	New York	Aug. 22

Time—Days, 104; *Hours,* 2496.

C—Eastward via England and New Zealand.

Mailed	*Date*	*Arrived*	*Date*
New York	May 10	Halifax, England	May 23
Halifax, England	May 23	Wellington, N. Z.	July 14
Wellington, N. Z.	July 14	New York	Aug. 29

Time—Days, 111; *Hours,* 2664.

D—Eastward via England, Ceylon and Japan.

Mailed	*Date*	*Arrived*	*Date*
New York	May 10	Halifax, England	May 23
Halifax, England	May 24	Colombo, Ceylon	June 15
Colombo, Ceylon	Aug. 25	Tokyo, Japan	Sept. 27
Tokyo, Japan	Sept. 27	New York	Oct. 17

Time—deducting delay (71 *days*), *owing to abscence of Commissioner at Ceylon.—Days,* 89; *Hours,* 2136.

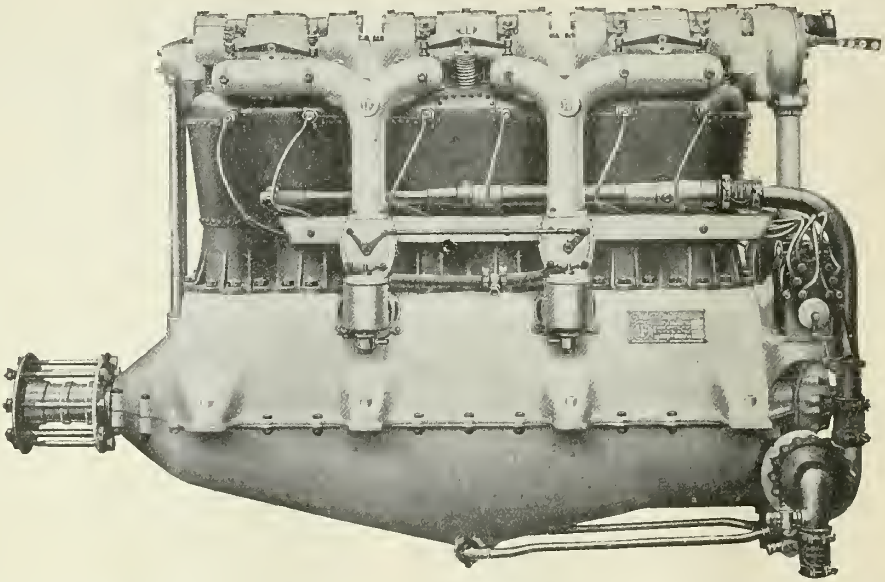
(*Concluded from page* 180)

$s = 140$ mm., $i = 11$, hence $v_h = 18.6\, l$, $\epsilon = 5$ and $n = 900 + 900$ r.p.m., gives a power of $N_e = 160$ HP up to about 3500 m. altitude, with a fuel consumption of about 274 g/HP-hr. (in agreement with the HP adopted by Adlershof for the S-H III Engine No. 9807 on July 2, 1918).

Taken together, the examples show a remarkably satisfactory agreement with practical results. In all cases the deviations are less than 5%, which is only a reasonable allowance.

Summary

We have developed a simple fundamental formula for the preliminary calculation of cylinder dimensions on the basis of the air requirement of the fuel for the various efficiencies. For the various engine types we have given the pertinent values of the efficiencies, together with the required stroke volume for some particular engine of each type, in which there is very good agreement with the engines specified. Equally good agreement has been established between the calculated fuel consumption and that found by actual experiments.



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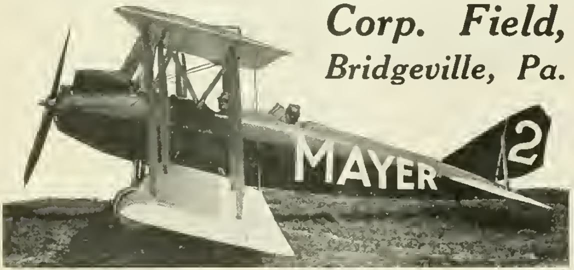

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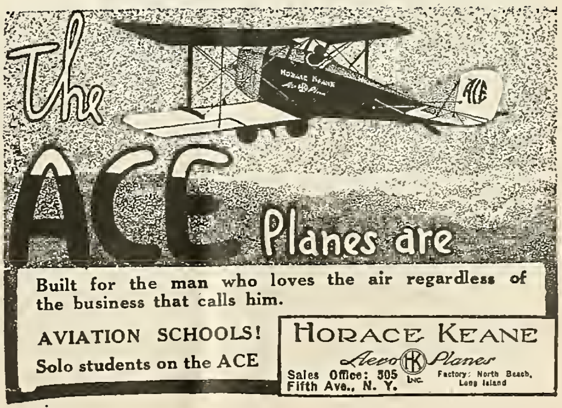
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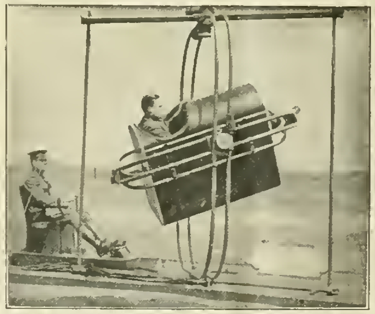

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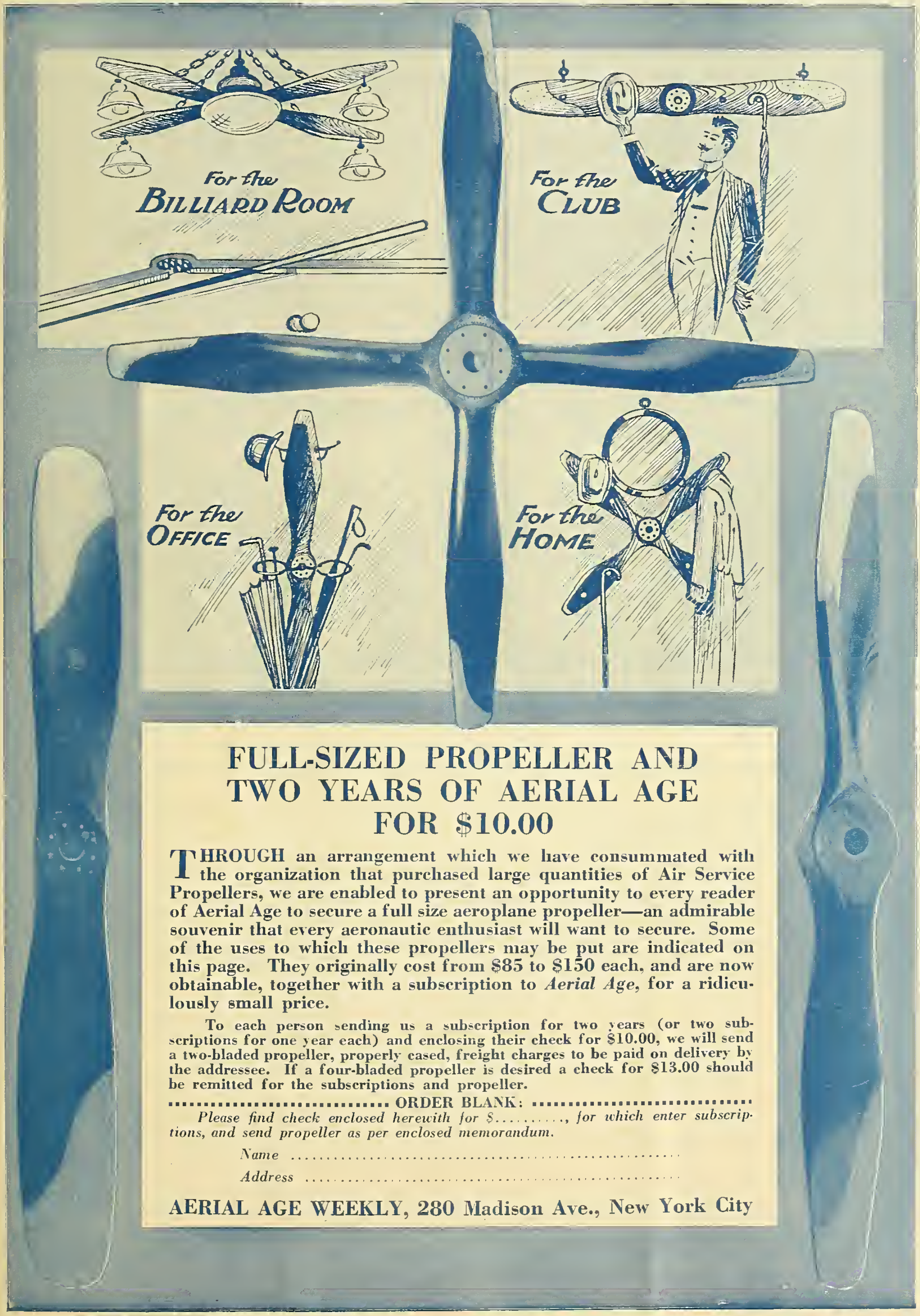

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NEW YORK

AERIAL AGE
WEEKLY

VOL. 14. No. 9 NOVEMBER 7, 1921 10 CENTS A COPY

Airscape of Columbia University District Photographed for the Fairchild Aerial Camera Corp. by W. L. Hamilton

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The JL-12 Attack Plane—The Orenco F4 Tourister—Helium for Airships

UBLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
ubscriptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

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AERIAL AGE WEEKLY

VOL. XIV, No. 9

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VOL. XIV NEW YORK, NOVEMBER 7, 1921 NO. 9

STANDARDIZATION IN AEROPLANE DESIGN

IN last week's issue the question of the standardization of semi-raw materials, such as tubing, sheet and plywood was brought up. Such standardization is basic and would do much to improve aeroplane design in this country. But the work of standardization can, with tremendous advantage, be carried much further, into the realm in which many designers jealously feel it has no place. They are inconsistent, however, for who among them would design a special wheel or tire for an ordinary aeroplane instead of selecting one from among the standard sizes? Yet why should not control masts for rudders, elevators, and ailerons be standardized just as well as wheels? Entirely too much time is being spent in redesigning for every new job scores of parts that it should be possible to select from stock catalogues.

On several occasions, the writer has talked to other engineers on this subject of standardization, things that should be standardized and methods for doing it. One of the great services that McCook Field can render the aeroplane industry is to take up this work. No other institution can effectively handle the problem, and it is entirely beyond the scope of any private organization. If the standards established are to endure, they must be the result of painstaking efforts of several engineers. In this way, by the pooling of ideas and the elimination of all but the best, standards can be evolved which will be far superior to the efforts of any one designer.

In the design of standard parts, several factors must be given careful consideration. Among these, weight is one of the most important. Far too much weight is being carried around on most aeroplanes in the form of non-structural details. So in standardizing a part or series of parts, the questions must be asked, can duralumin be used instead of steel, and can any more material be cut off without jeopardizing the strength of the piece? Obviously sufficient strength is a prime requisite. There should be no uncertainty as to whether the part is strong enough. Next, if the part is to be of any value, it must function properly. Finally, it is essential that all standard parts be as inexpensive to make as possible. These are the points which must be attended to if the standards are to be satisfactory.

What now are some parts which lend themselves best to standardization? Wheels, tires and control masts have already been mentioned. Seats offer many possibilities. Two seats being made in the same shop at McCook Field at the same time and for the same purpose weighed two pounds and nine pounds, respectively. Perhaps two or three standard seats of this type would meet all the requirements. Such a thing as the standard plywood rib used by McCook Field in practically all small rib design is another instance. The methods of securing the ribs to the spars which have been approved should certainly be standardized. Controls are well suited to standardization. There is no need for more than perhaps two sizes of rudder bars and maybe two styles. Control sticks of either wood or metal could readily be made up in standard form and kept in several different lengths. Two or three sizes of controls for a "dep" control would be ample. Several efforts, attended with considerable success, have been made toward standardizing cockpit dimensions, i.e., the relation of the seat to the air and engine controls. The general arrangement of instruments can also be standardized.

In addition to what might be termed absolute standardization of definite small units or parts there can be standardization in general design. For instance, why should a different type of chassis be designed for each aeroplane? A really satisfactory chassis is rare. Why not standardize, therefore, several types of chassis and merely change the angles, lengths and gages of the struts to fit the case? Why should not engine mounts be standardized the same way? There are very few good types. Such a matter as wing tip shape, if standardized would save much worry. Are not simple square tips rounded off with fairing better than the elaborately raked or rounded ones of the past?

With so many worries off his mind, a designer is left free to devote more time to real engineering and design work.

—B. C. B.

THE NEWS OF THE WEEK

Progress in Assembling the Airship "Roma"

The Airship "Roma," recently purchased by the United States from Italy, arrived at Langley Field in excellent condition in every respect, the envelope which contains the gas coming through in exceptionally fine shape. The envelope is at present inflated with gas, and the keel, which runs along the entire length of the ship, is completely assembled, as well as the greater part of the 6-power units.

It is expected that this ship will be ready for its trial flights in this country by November 1st, or shortly thereafter.

The "Roma" has a range of action of approximately 3,500 miles at 80 miles per hour. At cruising speed, a distance of 8 000 miles is estimated. Its capacity is 1,200,000 cubic feet, length 410 feet, width 82 feet, height 88.6 feet, and useful load in the neighborhood of 19 tons. It is driven by six 12-cylinder, 400 h.p. Ansaldo motors. It is contemplated substituting Liberty motors of corresponding horsepower for them at such time as they will require replacement. The ship is of a semi-rigid design, and practically no internal pressure is required to maintain its form under flight conditions.

Upon its entry in service numerous experimental projects in connection with the functioning of the Army Air Service will be carried out, including long-distance reconnaissance flights, photographic missions, coast patrol work, and the carrying of supplies for heavier-than-air units.

Under favorable conditions this ship is capable of making a non-stop flight from the Atlantic to the Pacific coast.

Elk Hunting by Aeroplane

As time goes on one cannot escape the growing conviction that the field of usefulness in which the aeroplane can be utilized is practically without limit. Mr. J. S. Hunter, of the Fish and Game Commission, hit upon the aeroplane as the means of fulfilling his desire to ascertain the number of elk in the vicinity of Buena Vista Lake, California, and with that end in view a special aeroplane flight was made from Visalia, California, on September 11th last.

A plane, piloted by Lieut. G. A. McHenry, Air Service, with Mr. Hunter as passenger, took off from the Visalia Field at 6:15 a. m., when a direct flight was made to Button Willow. At an altitude of 1,000 feet, flight was made along the edge of Elk Hills towards Buena Vista Lake. A return course was then taken a few miles north, and here a herd of ten elk were located and pictures of them were taken by Mr. Hunter. The entire country from the mountains on the south to the Kern River on the north was patrolled at various altitudes. This open country was covered in a manner that assured Mr. Hunter that there were no elk there. Going east towards Bakersfield, Mr. Hunter observed another herd in the trees along the Kern River, but owing to an attack of "air sickness," he did not call the attention of the pilot to this fact. He stated that owing to the heavy growth along the river it was not possible to estimate the number in this herd.

While this flight did not give an estimate of the number of elk in this section, it did show that the number here had been overestimated in the past.

Ten Planes Enter for Pulitzer Race

Omaha.—There are ten entrants for the second annual Pulitzer Trophy races for aeroplanes having a speed of more than 140 miles an hour, to be held November 3. Eighteen have entered for the John M. Larsen Trophy contest November 4, it was announced by Earl W. Porter, President of the Omaha Aero Club, when entries for both events closed October 25.

Both contests, and others, will be held in connection with a National Aero Convention called to form an organization to stimulate interest in aviation in the United States.

Aero Miles City Club

The Aero Miles City Club of Miles City, Montana, proved this year that commercial aviation can be and is successful in Montana and showed that there are many possibilities along this line which are bound to come in the future. With two Curtiss Standards and a Curtiss J-N 4, a good passenger and fair exhibition business was maintained throughout the summer and fall. The activities of the organization are state-wide. The Club gave the aerial exhibitions for the Montana State Fair in September, for the Miles City Roundup and several other smaller fairs.

The Club is a pioneer in the commercial aviation field in this state and the success attained is a tribute to Pilots E. T. Vance and A. W. Stephenson, as well as to others who have backed the project. W. G. Ferguson, secretary of the Club, is Disional Chairman for the World's Board of Aeronautical Commissioners for the State of Montana.

Aerial Mail Report

The report of performance of the Air Mail Service from July 1 to September 30, 1921, shows a percentage of 98. The best record for one complete quarter since the service was established. The performance of the entire service was as follows:

Percentage of performance, 98; number of miles flown with mail, 391,018; number of letters advanced, 10,014,280. The performance by Divisions: New York - Chicago, 98.5%; Chicago - Rock Springs, 97.6%; Rock Springs-San Francisco, 98%.

In addition to the 391,018 miles flown with mail on regular schedule, the records show 49,662 miles of test flights and ferry trips, making a grand total of 440,680 miles flown in the three months.

During the quarter we had eleven (11) crashes. In two accidents the ships were completely destroyed. In eleven cases of damage eight occurred on our fields and three at points of forced landings.

During the quarter there were no fatalities or injury to employes on regular mail trips. However, there was one fatality on a ferry trip. On July 16, 1921, Pilot Howard Smith lost his life in ship No. 222 on the San Francisco field. He was assigned to ferry this ship to Reno and fell from an altitude of 300 feet on the home field.

The cost per mile of operation during this period was: July, 73c; August, 71c; September, 70c. This shows an average of 71 1/3 cents per mile during this period. The records show that the cost during the same quarter of the year 1920 was 87 cents per mile.

An exceptionally good record is being made on that portion of the Transcontinental Route between Cleveland, Ohio, and Chicago, Illinois. The air distance is 335 miles. The last date on which a mail trip was defaulted was April 29, 1921. We have completed 24 weeks of 100% performance on this leg of the route and we are now on our 25th week without a break. During the 24 weeks, the mails were flown 96,480 miles without default.

A record flight was made by mail planes between Salt Lake City and San Francisco on Friday, October 14th. The time consumed from take-off at Salt Lake City (5:32) and arrival at San Francisco (11:33) was six hours and one minute. A stop for service of eleven minutes was made at Elko and a twenty-minute service stop was made at Reno; therefore, the actual flying time was five hours and thirty minutes.

Train No. 9. the fast exclusive mail and express train operated over the Southern Pacific Railroad has a schedule of 24 hours and 15 minutes between Salt Lake City and San Francisco.

The Sport Farman Taking Off at the Aero Club Meet at Curtiss Field. Some Climbing Angle

International Aero Congress

At the International Aero Congress, at Omaha, Nebraska, November 3-5, it was planned to discuss the following interesting topics:

Technical: 1. The applications of the results of wind tunnel tests of small models to the design of full size aircraft.

2. Commercial aeroplanes and seaplanes of monoplane or multiplane construction; thick and thin wings.

3. Dirigibles of large carrying capacity.

4. Aircraft motors for commercial use. Manner of mounting; method of transmitting power to the propellers.

5. Instruments for locating the position of aircraft and plotting their course.

Aerial Navigation: 6. Laying out and marking of aerial routes.

7. Installation and operation of airports.

8. Types of commercial machines; their adaptation to various kinds of transportation (passenger, postal, etc.). Record of safety of this means of transportation.

9. Insurance.

10. Aerial travel (Questions of law and customs; Discussion of Wadsworth Bill).

11. Physical and professional requirements for pilots; Source from which pilots are to be obtained.

The Aeroplane in Future Wars

"The aeroplane will be the most destructive force in the next war, which will be fought with all the horrible and terrible inventions that the mind of man can conceive," according to Mr. Hudson Maxim, the noted inventor, in an address he recently delivered before the Dayton, Ohio, Chamber of Commerce. Mr. Maxim declared that it will be possible to send the aeroplane anywhere, and there will be no force that will be able to combat it effectually; that when the next war comes the aviation forces will prove the greatest enemy of the navy, as Super-dreadnaughts and the latest inventions for naval warfare will not be able to fight this enemy in the sky. It will be necessary for the United States to have a merchant marine of the air which will equal that of any other nation and which can be easily converted into war machines. Without any such force, he contended, any country will be at the mercy of a nation which equips itself with such protection. The marine of the air is the only solution for the problem. Aeroplane production must be made so that ships will be perfectly safe, and decision to establish a merchant marine will mean the production of ships on a great scale both for industrial and military purposes.

Air Mail Service Praised

Postmaster General Hays recently congratulated the Air Mail Service in an open letter as follows:

We have been receiving some praise for the speed in handling the mails between New York and San Francisco, and I want to commend the work of the force in the Air Mail Service for their part in this quick handling of letters, also for the really wonderful record that you have made in the Air Mail Service during the last three months. Second Assistant Postmaster General Shaughnessy has furnished me with information as to how a letter, mailed in San Francisco after the departure of the passenger, was delivered in New York City before the passenger arrived by train.

The lady to whom the letter was addressed left San Francisco on the Overland Limited at 11 a. m. Monday and arrived in New York 10 a. m. Friday on the Twentieth Century. The daughter of the lady mailed the letter at San Francisco which left on an Air Mail plane at 2.30 p. m. Monday on regular schedule, flew to Reno, overtaking the Overland Limited. We dispatch all eastern mail to that train at Reno.

New York mail is carried on the Overland Limited to Cheyenne, arriving there at 5.25 Wednesday morning. The New York mail is taken off train No. 2 at Cheyenne, and an Air Mail plane leaves Cheyenne at 6 a. m. and arrives in Chicago at 6 p. m. the same day, connecting with New York Central train No. 32, which arrives at New York 4.45 Friday morning.

Without the aid of the Air Mail Service the letter in its regular course would have been delivered to the addressee in New York on Saturday afternoon.

Oakland Aero Club

The Oakland Aero Club of Oakland, Iowa, wish to announce that all pilots are welcome to land on their new airdrome, 3 miles southwest of Oakland, Iowa (on the Chicago-Omaha Air Mail Route). High test gas, oil and repairing available.

The field is marked by a large white cross in the best section of the field, which contains sixty acres, all level and good approaches. No obstruction, excepting a steel tower thirty feet high on the southern boundry of airdrome, on which is mounted the wind indication.

Mr. W. H. West, President; Lieut. Don Heyer, Vice-President: Mr. Oran Brown, Secretary, and Mr. Wilbur Nilan, Field Supt., of the Oakland Aero Club are responsible for the activities of the Club and the new field.

UNITED STATES POST OFFICE DEPARTMENT—AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, September 1921

DIVISION	Gasoline	Grease and Oil	Repairs and Accessories	Miscellaneous	Motorcycles. Trucks	Rent, Light, Fuel, Power, Telephone and Water	Office Force and Watchmen	Warehouse	Pilots	Mechanics and Helpers	Testing & Experimental Work at College Park	Radio	Departmental Overhead Charge	TOTAL	SERVICE AND UNIT COST Gallons of Gasoline	Total Time Run hrs. min.	Total Miles Run	Cost per Hour	Cost per Mile
EASTERN New York-Chicago.....	$4,893.09	$926.55	$3,995.04	$2,934.55	$1,724.48	$774.34	$3,038.57	$1,570.60	$4,468.60	$5,409.27	$221.36	$1,674.00	$811.95	$32,442.40	13,399	463 39	41,508	$69.96	$0.78
CENTRAL Chicago-Rock Springs	5,232.58	1,524.19	*6,432.95	3,603.92	1,092.47	524.06	3,026.23	2,274.67	6,249.47	5,169.71	320.59	2,424.40	1,175.93	39,051.17	18,857	722 55	62,941	54.01	.62
WESTERN Rock Springs-San Francisco	3,405.15	782.04	†8,314.46	2,151.81	1,124.82	427.19	3,215.22	1,570.60	3,611.51	4,194.77	221.36	1,674.00	811.95	31,504.88	11,697	480 33	43,650	65.56	.72
Totals and Averages.....	$13,530.82	$3,232.78	$18,742.45	$8,690.28	$3,941.77	$1,725.59	$9,280.02	$5,415.87	$14,329.58	$14,773.75	$763.31	$5,772.40	$2,799.83	$102,998.45	43,953	1,667 07	148,099	$61.78	$0.70

* Includes rebuilding plane No. 210, and new wings on plane No. 177.

† Includes new wings and ailerons on plane No. 107, new wings and center section on plane No. 158.

Total Operating Cost	$102,998.45
Loss on Unrepairable Crashes	8,000.00
Permanent Improvements	6,221.84
Grand Total	$117,220.29

COST PER MILE

Division	Overhead	Flying	Maintenance
Eastern	$0.20	$0.25	$0.33
Central	.14	.20	.28
Western	.17	.18	.37
Entire Service	$0.17	$0.21	$0.32

Overhead consists of:
Departmental Overhead; Office Force and Watchmen; Motor Cycles and Trucks; Rent, Light, Fuel, Power, Telephone and Water; Radio; Testing and Experimental Work.
Maintenance consists of:
Miscellaneous; Mechanics and Helpers; Repairs and Accessories, and Warehouse.
Flying consists of:
Gas; Grease and Oil, and Pilots.

E. H. SHAUGHNESSY, Second Assistant Postmaster General.

The AIRCRAFT TRADE REVIEW

Key West-Havana Service to Resume

The Aeromarine Airways will continue this winter a service between Key West and Havana with five ten-passenger flying boats of the Santa Maria type. This particular route reduces the time of travel between Key West and Havana from seven hours (by boat) to seventy-five minutes; a saving of time and inconvenience which last winter was greatly appreciated by the traveling public, as indicated by the number of passengers carried without accident.

Plan Trans-Ocean Line

Buenos Ayres—Ninety hours from Cadiz to Buenos Ayres by airship is planned by Comandante Emilio Herrera, Spanish aviator and aviation expert. The plans are for a regular transatlantic passenger, mail and parcel service.

Herrera, who is returning to Spain after a visit here, said that a company is now being formed to finance this proposed first transatlantic air line. He hopes to be operating by 1923.

Operation of Forestry Patrol

A report from the Air Officer of the 9th Corps Area, summarizing the forest fire patrol activities for the entire season of 1921 up to September 1st, gives the number of fires discovered as 832; the number of patrols, 396; number of miles covered, 148,113; number of square miles observed, 7,230,459; flying time, 561 hours and 50 minutes; and the number of planes in commission, 47. The patrol bases were located at Camp Lewis, Wash.; Eugene, Oregon; Mather Field, Mills, Calif.; Corning, Calif.; and Visalia, Calif.

Due to the rainy season having begun, patrols in the States of Oregon and Washington were discontinued on September 10th, after having completed a very successful season, despite the shortage at times of gasoline and oil, necessitating the temporary suspension of operations.

A report from the Department of Agriculture states that the entire forest area in the United States covers 463,000,000 acres, and that this region is being burned over at the rate of 10,000,000 acres yearly, reforestation requiring a minimum of 20 years.

According to a statement which recently appeared in the newspapers, in 1920 the Air Service in 2½ months' operation of the forest fire patrol, saved from destruction by fire standing timber valued in excess of $35,000,000, or considerably more than the entire appropriation that year for the air defense of the United States.

This is a fitting testimonial to the great utility and value of the aeroplane in peace time pursuits—not to mention its functions in war—and a striking illustration of the important part the aeroplane is playing in conserving the natural resources of this country.

The excellent results obtained through the patrol by aeroplanes in locating forest fires has attracted wide attention and has led the Canadian Government and large timber corporations in the Dominion to establish the foundation for similar services.

Reduction in Naval Air Service

The curtailment of the activities of the Navy Air Service up to date has closed the stations at Cape May, N. J.; Yorktown, Va. (branch of the Hampton Roads Air Station), and Rockaway, N. Y. This leaves operating stations on the Atlantic Coast at Hampton Roads, Va.; Lakehurst, N. J.; Anacostia, D. C., and Pensacola, Fla., and on the Pacilc Coast at San Diego, Calif. Of these the Hampton Roads and the San Diego stations are the only sizeable ones now existing, as far as the Navy is concerned.

Due to the crash in England of the R-38, the airship station at Lakehurst is in a peculiar situation. What will be done with the station remains to be worked out following the financial settlement over the R-38, which will soon be taken up with the British government. If it is possible to obtain—as some of the high officers of the Bureau of Naval Aeronautics hope—one of the British dirigibles as part payment in the settlement, the activities at the Lakehurst station will be resumed. Otherwise they will cease for about a year, when it is expected that the airship ZR-1, now building at the station, will be completed.

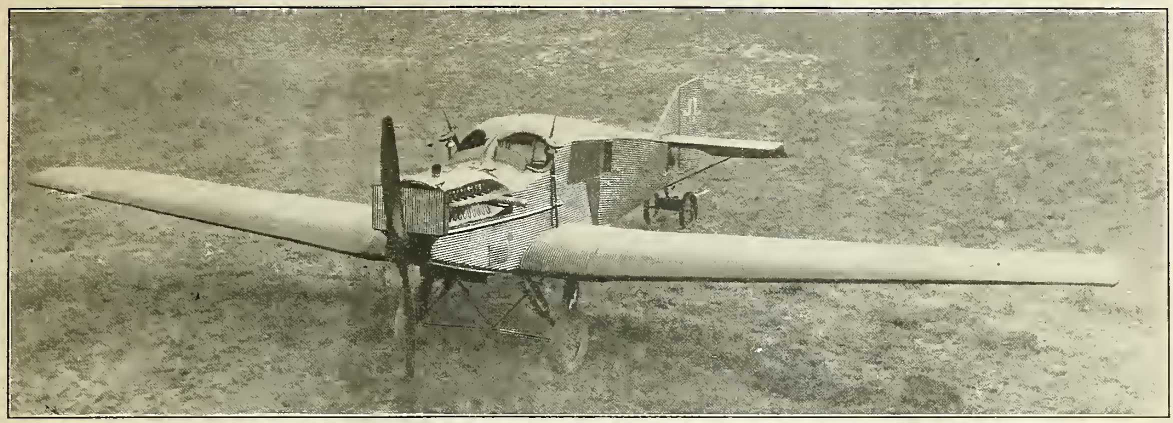
The Anacostia station, just outside of Washington, is maintained largely for experimental purposes. It is not regarded as an ideal naval air station in the accepted sense.

The station at Pensacola serves for training purposes, to supply fliers for the Atlantic and Pacific flees.

The reductions are due to the failure of Congress to provide sufficient funds for the maintenance of the additional stations. The appropriation for the current fiscal year amounts to $13,300,000, which includes funds for new aircraft.

RALPH C.
DIGGINS CO.
CAGO NO. 2

An interesting group of aerial notables at the Ralph C. Diggins field. Left to right: Ethel Dare, plane change and wing walker, Al Wilson, Miss J. Bradley, Ruth Law, James Curren, chief instructor Diggins School, Mr. Lewis James, 19 year old aerialist, and Elmer Partridge, expert pilot



THE JL-12 ATTACK PLANE

THE JL-12 Attack Plane was designed and built by John M. Larsen, a well-known engineer and inventor, who in the course of his aerial touring has flown between 250,000 and 300,000 miles in this country and Europe. It is a type in advance of the latest foreign all-metal planes. The plane is 32 feet long with a wing spread of 49 feet and carries 130 gallons of gasoline. When manned by pilot and gunner and equipped with 3,000 rounds of ammunition and fuel for 500 miles of flight, it weighs 5,000 pounds. Its radius of action in battle is 400 miles from its supply base. The engine is a 400-horsepower Liberty motor.

The main battery of the plane consists of twenty-eight machine guns arranged in two sections. The first section is of twelve guns located directly behind the pilot's seat, and the second of sixteen guns, is mounted to the rear.

The firing is done by the manipulation of three levers, one firing half the battery, another the other half, the third being a master lever which puts all twenty-eight guns into action with a single motion. The two remaining guns of the thirty are fired at will by the pilot or gunner from the cockpit. The replacement of fresh magazines for all the guns requires only four minutes.

The plane itself is constructed of American-made duralium. The metal sheets are 25-1,000 of an inch thick, more than twice the thickness of that used in the latest foreign all-metal planes. It is braced throughout with steel, there being a powerful criss-crossing of rods in the wings, which are two feet thick at their greatest diameter.

In designing this plane, it was Mr. Larsen's idea to provide a flying machine which, through its high speed, its sensitiveness under control and its ability to climb rapidly, could be used successfully against infantry either on the field of battle or while "going up," or to the rear, or to attack a convoy on a roadway. The intent of the plane is to swoop down upon the enemy, fly low over him, perhaps at not more than fifty feet from the ground, and loose an annihilating fire from machine guns. After such a dash, the machine is to climb swiftly to give the gunner time to adjust new magazines to the guns and then to return to the attack.

By manipulation of the ailerons of the plane, the latter can be made to rock back and forth above the object attacked and thus spray the ground with bullets for a wide distance. The forward Thompson guns are set at a slight forward angle, six in the second battery point directly downward and the remainder are trained slightly aft, so that fire from the plane flies in three directions simultaneously.

The circular drums for the Thompson guns contain 100 cartridges and the ammunition equipment for the plane in battle trim consists of three drums for each of the thirty guns, a total of 9,000 cartridges.

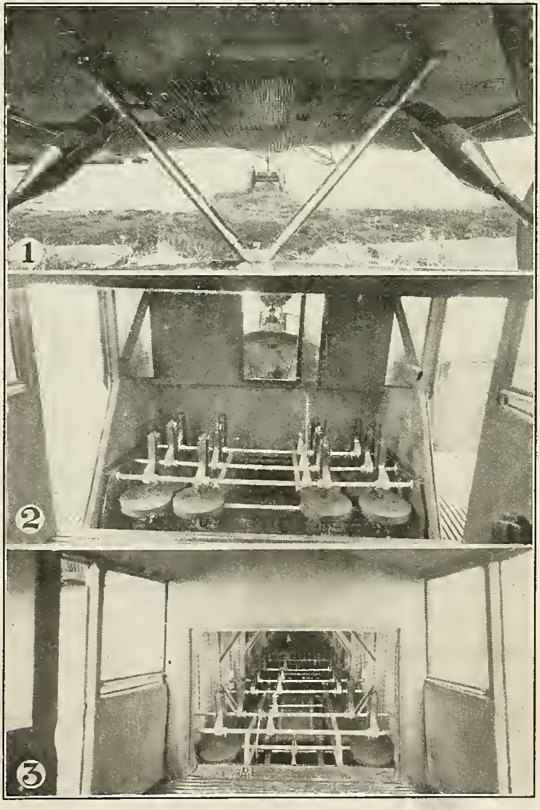
In discussing the machine Mr. Larsen stated: "It has been put through the most severe tests already and the flying and the battery performance have been perfect.

"One marked feature of the plane is its climbing ability. During a recent test it climbed the first 1,000 feet in 45 seconds and rose to 10,000 feet in less than 12 minutes. It is as fast as a scout plane and has high qualities of maneuvering at speed.

"Nothing has been overlooked to make it an irresistible weapon of war. Infantry, either in the open or intrenched, cannot possibly withstand its sheer velocity of flight and its appalling fire. It flies too fast to afford a target. It sets a pace which is strides ahead of anything like it in the world, and the best part of it all is that this plane is of American material and workmanship throughout."

Specifications

Type—All-metal monoplane.
Span—49 feet.
Length Overall—32 feet.
Height to Top of Cabin—400 horsepower.
Motor—Liberty 12—400 horsepower.
Control—Dual dep.
Weight of Plane empty (including cooling water)—2900 lbs.



1. View under surface of plane toward the rear. 2. Looking forward in the interior. 3. Looking to the rear of the fuselage interior

Weight of Plane with:	
Armor, Armament of thirty (30) machine guns with loaded magazines, spare magazines and ammunition	3848 lbs.
Fuel for 4 to 5 hours	800 lbs.
Pilot and Gunner	352
Total	5000 lbs.

Maximum Speed—140-145 miles per hour.

Landing Speed—55-60 miles per hour.

Climb—1st 1,000 feet in 46 seconds; 10,000 feet in 11 minutes.

Armament—Thirty (30) machine guns, mechanically operated.

Armor—9/64-inch thick Armor plate.

Wheels—800 x 200 mm.

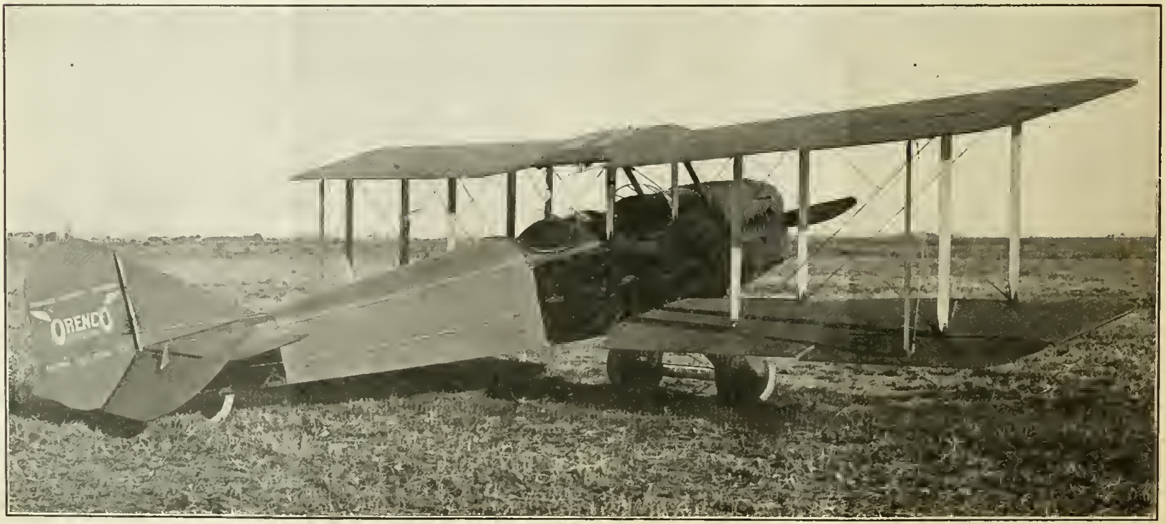
THE NEW ORENCO TYPE "F-4" TOURISTER AEROPLANE PROVES GREAT SUCCESS

The improved Orenco Type F Tourister aeroplane, the new "F-4", has proven itself equal to the difficult work of carrying 5 passengers in a comfortable manner at a very low operating cost. On its first flight on October 22d, Bert Acosta, accompanied by A. H. Phipps, the designer, took off in a short even run, climbed rapidly to 2,000 feet. After ten minutes spent in subjecting the machine to all the hard maneuvers likely to occur in ordinary flight, in order to severely test the controls, the machine was put into three successive loops, and the plane landed in a flat glide.

On the first trips, 50 gallons of gasoline and 6 gallons of oil were carried. Strict records were kept of the fuel consumed to determine the actual operating cost. These records show the time spent in the air as compared with the fuel consumption, and indicate that the actual cost is but 90 cents an hour per person, or less than one cent a mile per person.

Acosta, on the first flight, tried out the balance of the ship and found it to require no alterations. As the elevators are of the balanced type, they relieve the pilot of a great deal of the arm-strain. The F-4 is equipped with the new Model E-2 Wright engine developing 190 H. P. The speed was measured over a carefully marked course. The cruising speed is 95 miles an hour and the high speed, 110 miles an hour, a remarkable performance with such a load and such low horse-power. A specially designed and highly efficient Hartzell propeller is one of the features to which the speed is attributed.

On the following day E. F. White flew the machine carrying Mr. E. R. Michie, Vice-President of the Ordnance Engineering Corporation, his son, Jack and daughter, Katherine as passengers. Several other passengers were carried on October 23d, including Miss White, Miss Sarah Cook, R. C. Greenwood, Wm. F. Schult, John M. Beck, Jr., and George Page. An altitude flight to 15.000 feet was made by Art Heinrich, with 3 representatives of the press and the Aero Club of America. Motion pictures were made over New York City. Demonstration flights are being made on week-ends and during the week by appointment. As fuel can be carried for five hours, cross-country flights of 500 miles or more may be made with ease. Dual controls provided in the rear cockpit allow two pilots to alternate handling the ship and permit instruction in the easiest manner possible.



The Orenco Type F-4 Tourister

THE RESISTANCE OF AEROFOILS

By W. F. GERHARDT

Aeronautical Engineer, McCook Field

(A review of some of the most important ideas developed by Dr. Geo. de Bothezat in his Aerofoil Memoir.*)

(*Continued from page* 178).

The foregoing discussions of the laws of air resistance of aerofoils interprets the empirical results which are of most immediate use in aviation. A deeper knowledge of the relations which govern the phenomena requires an analysis of the airflow around the aerofoil.

The Flow Around an Aerofoil

WHEN an aerofoil moves through the air with a uniform rectilinear velocity of translation, the following flow phenomena are observed.

As previously mentioned there occurs the well known pressure distribution and the deflection of the air stream in the sense opposite to that of the lift. In addition there can be observed a periodicity to the flow in the wake of the aerofoil due to the system of vortices there formed, called the edge vortices, the axes of which are perpendicular to the stream velocity; and two vortices coming off the tips called the tip vortices with axes parallel to the direction of motion.

In order to picture the general nature of the fluid flow and to evaluate the relations which govern the action of these component phenomena, Dr. de Bothezat develops an ideal scheme of the flow. This scheme is only a conceptual limit, which the actual merely approaches, but it takes account of the fundamental variables, and permits of the calculation of the relations between them.

Scheme of Fluid Flow

Consider a cylindrical body (Fig. 21) of infinite length and having a plane of symmetry parallel to the direction of its velocity V_0. Let us imagine an observer moving with the body. For such an observer a relative stream of air will run on the body. This effective or relative stream can be replaced by a conventional relative stream so defined that it will be fully equivalent to the actual stream so far as the resistance encountered by the body is concerned.

Let us first assume that in each cross-section of the stream, normal to the plane of symmetry, the velocity of the air-stream is constant. In order to take care of the fact that the stream has a greater velocity than that of the surrounding air, due to the presence of the body, we must consider that this relative stream is limited in section and bounded on the outside surfaces of discontinuity S S, and at the body, by the surfaces of discontinuity S^1 S^1. We thus see that in this scheme, the flow is inmodified outside S S; between S S and S^1 S^1 the velocity is in excess of V_0; inside S^1 S^1 the velocity is zero.

In this conception of the flow phenomenon, the vortices are considered to be concentrated on the body and the outside boundary, that is, the surfaces of discontinuity are vortex sheets. This is a condition which seldom occurs, as the vortices are finite and spread throughout the fluid. The actual case may be considered as a breakdown of this ideal case.

Consider two sections of the relative stream I and II, immobile relative to the body and normal to the stream. Section I of conventional height h_0, is taken in front of the aerofoil at such a position not reached by the disturbance created by the body. The relative velocity and pressure in this section are V_0 and p_0. Section II is taken behind the body where the velocity and pressure are V and p.

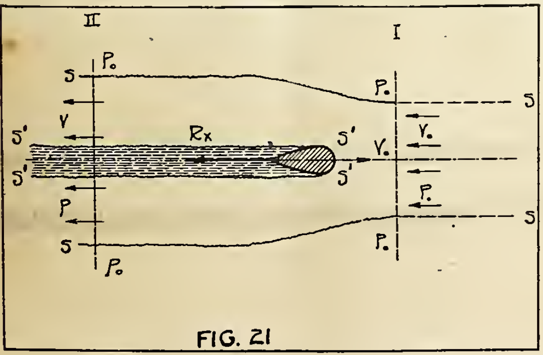


FIG. 21

If C is the Bernouilla constant corresponding to Section I,

$$p_0 + \frac{\delta V_0^2}{2} = C \tag{17}$$

If we follow a stream line in the relative motion of the fluid with respect to the body we find that, starting with the pressure p_0 and velocity V_0, the pressure decreases and the velocity increases as we pass the body; further on the pressure increases and the velocity decreases until at Section II we have the velocity and pressure V and p.

In the movement from I to II, losses occur inside the fluid by viscosity and at the surface of the body by "skin friction,"—that is, some energy $\triangle C$ is dissipated in heat. Hence in Section II,

$$p + \frac{\delta V^2}{2} = C - \triangle C \tag{18}$$

$$\triangle C = p_0 - p + \frac{\delta}{2}(V_0^2 - V^2) \tag{19}$$

But $\triangle C$ is nothing more or less than the interior work of a volume of the relative flow crossing the two sections. This unit volume is

$$h_0 V_0 = hV \tag{20}$$

and if π is the total work

$$\triangle C = \frac{\pi}{h_0 V_0} \tag{21}$$

But this work can always be considered as the product of a ficticious force F and the velocity V_0.

$$\pi = FV_0 \tag{22}$$

Hence

$$\triangle C = \frac{FV_0}{h_0 V_0} = \frac{F}{h_0} \tag{21^1}$$

or

$$F = h_0 (p_0 - p) + \frac{\delta h_0}{2}(V_0^2 - V^2) \tag{23}$$

The above is the general picture of the flow about the body.

Let R_x be the drag per unit of length of the body. Let us apply the momentum theorem to the fluid between the boundaries and the body, included between the planes I and II (considered to be a unit distance apart). This theorem states that in a system of bodies, the algebraic sum of the exterior forces must be equal to the change of momentum of the system per unit of time. In this case the exterior forces are the drag on the body and the resultant pressure. This latter force is $h(p_0 - p)$ and is applied normally to Section II.

$$R_x - h(p_0 - p) = (\delta h_0 V_0) V_0 - (\delta hV) V \tag{24}$$

or

$$R_x = h(p_0 - p) + \delta (h_0 V_0^2 - hV^2) \tag{25}$$

It is at once evident that the drag is about equal to the dissipative force F.

Suppose, for example, we choose section II at such a position in the stream where $V = V_0$. It follows from (20) that $h = h_0$. Hence from (25)

$$R_x = h_0 (p_0 - p) \tag{25^1}$$

and

$$F = h_0 (p_0 - p) \tag{23^1}$$

hence

$$R_x = F$$

Or let Section II be taken where $p = p_0$. Then

$$R_x = \delta (h_0 V_0^2 - hV^2) \tag{25^{II}}$$

$$\begin{aligned} F &= \frac{h_0 \delta}{2}(V_0^2 - V^2) \\ &= \frac{\delta h_0 V_0^2}{2} - \frac{\delta h_0 V^2}{2} + \frac{\delta h_0 V_0^2}{2} - \frac{\delta h_0 V^2}{2} \\ &= \delta h_0 V_0^2 - \frac{\delta}{2}(hV^2 + h_0 V_0^2) \end{aligned} \tag{23^{11}}$$

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* "Introduction to the Study of the Laws of Air Resistance of Aerofoils," by Dr. G. de Bothezat, N. A. C. A., 1918.

$$= \delta\, h_o V_o^2 - \frac{\delta h V^2}{2}\left(\frac{h_o}{h} + \frac{h_o V_o^2}{h V^2}\right)$$

$$F = \delta\, h_o V_o^2 - \frac{\delta h V^2}{2}\left(\frac{V}{V_o} + \frac{V_o}{V}\right)$$

and since $\frac{V}{V_o}$ is very close to unity. $\frac{V}{V_o} + \frac{V_o}{V} \cong 2$

Hence $F = \delta\, h_o V_o^2 - \delta\, h V^2$

$R_x = F$

Let

(26) $F = f\,\delta\, b\, V^2$

where f is a characteristic coefficient depending on the form of the body the properties of the fluid, and the position of Section II. Also we have

(5)^I $R_x = k_x \delta\, b V^2$

Then when $V = V_o$ or $p = p_o$

$$f \cong k_x$$

It is evident that, since the energy in the fluid is dissipated in two ways,—by surface or skin friction (vortex sheets) and vortices (quincunx system), the former which can never be eliminated is the inferior limit of f.

The Infinite Aerofoil

Let us now apply this scheme of the fluid phenomenon to the aerofoil. All that has been said with regard to the body of pure drag applies to the aerofoil case, with the additional requirement that in the latter case there must exist a component of the fluid momentum normal to the stream in order that there be lift. The fluid stream must be directed downward.

This generalized scheme is shown in Fig. 22. The relative stream runs on the aerofoil with velocity V_o. It is bounded by the vortex sheets S S and S^1 S^1. Leaving the aerofoil it is first directed downward, but afterward comes back to its original horizontal position. Sections I and II are chosen by the above mentioned criteria.

As before. the dissipative force is

$$F = h_o\,(p_o - p) + \frac{\quad}{\frac{\delta\, h_o}{2}}\,(V_c^2 - V^2)$$

The resultant pressure on the liquid mass is still $h\,(p_o - p)$ normal to Section 11. (Summing up all the pressures).

Applying the momentum theorem to the case we have,

(27) $R_x - h\,(p_o - p)\cos\alpha = \delta\, h_o V_o^2 - \delta\, h V^2 \cos\alpha$

(28) $R_y + h\,(p_o - p)\sin\alpha = h\,\delta\, V^2 \sin\alpha$

Now in the case Section II is chosen where $V = V_o$, then $h = h_o$ and

(27)^I $R_x = h\,(p_o - p)\cos\alpha + \delta\, h\, V^2\,(1 - \cos\alpha)$

(28)^I $R_y = - h\,(p_o - p)\sin\alpha + \delta\, h\, V^2 \cos\alpha$

also

(23)^I $F = h_o\,(p_o - p) = h\,(p_o - p)$

(26) $F = f\,\delta\, b\, V^2$

then

(23)^I $F = h\,(p_o - p) = f\,\delta\, b\, V^2$

But

$R_y = k_y\,\delta\, b\, V^2$

$R_y = k_x\,\delta\, b\, V^2$

Substituting in (27)^I and (28)^I and simplifying

(29)^1 $k_x = \frac{h}{b} - \frac{h}{b}\cos\alpha + f\cos\alpha$

(30)^I $k_y = \frac{h}{b} - f\sin\alpha$

Hence

(31)^I $\sin\alpha = \dfrac{k_y}{\dfrac{h}{b} - f}$

(32)^1 $\cos\alpha = \dfrac{\dfrac{h}{b} - k_x}{\dfrac{h}{b} - f}$

or since

$$\sin^2\alpha + \cos^2\alpha = 1$$

$$k_y^2 + \left(\frac{h}{b} - k_x\right)^2 = \left(\frac{h}{b} - f\right)^2$$

then

(33)^I $h = \dfrac{b\,(k_y^2 + k_x^2 - f^2)}{2\,(k_x - f)}$

Neglecting the squares of k_x and f:

(33) $h = \dfrac{b\,k_y^2}{2\,(k_x - f)}$

Introducing this value of h in (31)^I

(31)^I $\sin\alpha = \dfrac{2\,k_y\,(k_x - f)}{k_y^2 + 2\,f\,(k_x - f}$

Neglecting $2\,f\,(k_x - f)$

(31) $\alpha = \dfrac{2\,(k_x - f)}{k_y}$

In the second case, when Section II is taken where $p = p_o$ we have from the momentum equations.

(27)^{II} $R_x = \delta\, h_o V_o^2 - \delta\, h\, V^2 \cos\alpha$

(28)^{II}

Simplifying, using relations (23)^{II}, (2)^1 and (3)^I

(29)^{II} $k_x = \frac{h_o}{b} - \frac{h_o}{b}\frac{V^2}{V_o^2}\cos\alpha$

(30)^{II} $k_y = \frac{h_o}{b}\frac{V^2}{V_o^2}\sin\alpha$

and

(31)^{II} $\sin\alpha = \dfrac{k_y}{\dfrac{h_o V^2}{b V^2}}$

(32)^{II} $\cos\alpha = \dfrac{h_x - f}{\dfrac{h_o}{b}\dfrac{V^2}{V_o^2}}$

But from the expression for the dissipative force F:

(23)^{II} $F = \frac{\delta_o\, h_o}{2}\,(V_o^2 - V^2) = f\,\delta\, b\, V_o^2$

we see that

$$\frac{V^2}{V_o^2} = 1 - \frac{2\,f\,b}{h_o}$$

and since $\sin^2\alpha + \cos^2\alpha = 1$, then

$$k_y^2 + \left(k_x - \frac{h_o}{b}\right)^2 = \left(\frac{h_o}{b}\right)^2 \left(1 - 2\frac{fb}{h_o}\right)^2$$

(33)^{II} $h_o = \dfrac{b\,(k_x^2 + k_y^2)}{2\,(k_x - f)}$

Neglecting the squares of k_x and f

(33)^{II} $h_o = \dfrac{b k_y^2}{2\,(k_x - f)}$

Substituting this value of h_o in (31)^{11}

$$\sin\alpha = \frac{2\,k_y\,(k_x - f)}{k_y^2 - 4f\,(k_x - f)}$$

or, neglecting small terms as before

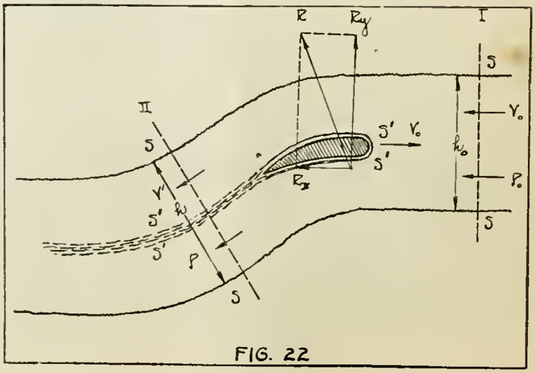

FIG. 22

$$(31)^{11} \qquad \alpha = \frac{2\,(k_x - f)}{k_y}$$

Let us now rewrite (31) and (33).

$$(34) \qquad k_x = f + \frac{\alpha\, k_y}{2}$$

$$(35) \qquad k_x = f + \frac{b\, k_y^2}{2\, h_o}$$

hence

$$(36) \qquad k_x = f + k_x^1$$

$$(37) \qquad k_x^1 = \frac{\alpha\, k_y}{2} = \frac{b}{2\, h_o}\, k_y^2$$

Whence

$$(38) \qquad \alpha = \frac{b}{h_o}\, k_y$$

We thus see that the total drag of an infinite aerofoil is the sum of two drags, the dissipative force f and the component of the momentum k_x^1 to the direction of motion. When $f = o$, i. e. in a frictionless fluid.

$$k_x = k_x^1$$

Considering relation (38) we observe that (1) if h_o is infinite, that is, the amount of liquid displaced is very large, then the angle α is infinitesimal and

$$k_x^1 = o$$

$$(39) \qquad k_x = f$$

(2) When h_o is finite and constant, that is, the amount of liquid is limited either artificially or by the nature of the flow, then

$$\alpha = C_1\, k_y$$

$$k_x^1 = C_2\, k_y^2$$

$$(40) \qquad k_x = f + C_2\, k_y^2$$

that is the drag is a parabolic function of the lift.

Actually, as has been observed, the wind tunnel tests show that the phenomenon takes place *nearly* as if the former assumption held true, and

$$k_x = f$$

Now f varies little with angle of attack since it is composed of friction forces. Hence, the *drag* of the *aerofoil of infinite aspect* ratio which is called the *profile drag* of a finite aerofoil is *neorly independent of the lift.*

It is the vortex system that produces the marked parabolic drag tendency.

(To be continued)

HELIUM FOR AIRSHIPS

In the course of an interview with a correspondent of a British newspaper shortly following the recent ZR2 Airship disaster, Major P. E. Van Nostrand, of the Balloon and Airship Division, Office of the Chief of Air Service, who was to have returned to America aboard the big dirigible, asserted that airships can be made safe, and that while Helium is the best gas known for airships—and he hoped the time will come when not only naval and military airships but commercial airships as well will be filled with Helium—petrol rather than hydrogen is the greater menace to the safety of airships. He is of the opinion that hydrogen can be used, and used safely, pointing to the fact that the hydrogen gas in the latter part of the ZR2 apparently did not explode, but came down intact, demonstrating that buoyant gas, if it stays in the bag, is a help rather than a danger. He added that if the ZR2 had been filled with Helium, the result of the accident would have been little more than a casual wetting for the men aboard her—provided a less explosive fuel than petrol had been in use.

At the present time, in view of the fact that the supply of Helium is very limited and difficult to obtain, the problem is to find a less volatile liquid for burning than petrol, and this, in Major Van Nostrand's opinion, is an easier proposition than to obtain Helium.

While touching on the subject of Helium, it might be well here to give a brief history of this new gas for use in airships, its present rate of production and the experimental work now being conducted therewith.

Helium is a gaseous chemical element discovered by Sir William Ramsay who, after numerous experiments, found that it refused to oxidize when sparked with oxygen. It is the lightest of absolutely inert gases, and occurs in the air in proportion of 0.000056 per cent by weight, or about one volume of Helium in 250,000 volumes of air. It also occurs in many minerals, including monazite sands, in the gases of many mineral springs, and in comparatively large quantities in several of the natural gases of Canada and the United States.

Commercially pure Helium has 92.6% lift of pure Hydrogen, and being absolutely inert has no deteriorating effect upon balloon fabrics, and is safe from combustion under all conditions. It is the all-round ideal balloon gas so long sought by scientists.

Up to April, 1918, Helium had been obtained only in extremely small quantities, and for scientific purposes only—the total amount probably not exceeding 100 cubic feet, at a cost of about $1,700 to $2,000 per cubic foot. The most promising fields thus far discovered are located in Texas, Kansas, and Ohio. It is believed by scientists that other sources of supply will be discovered, susceptible of development for the production of Helium in balloon quantities, as the result of exploration work. At the present time such an exploration program is being actively prosecuted by the Government.

After our entry into the war three experimental plants for the production of Helium from natural gas obtained from the Petrolia pool at Petrolia, Texas, were erected. Two of these, known as Plants No. 1 and No. 2, were located at Fort Worth, Texas, the gas being supplied through a pipe line from the former place, and the last plant, known as Plant No. 3, was established at Petrolia.

The cost of producing one cubic foot of Helium in a mixture of 92% purity in Plant No. 1, the most successful plant to date, was about 39c, showing the extremely remarkable reduction in the price of producing Helium, especially when the fact that this was an experimental plant and not of such proportions as to give lowest cost, is taken into consideration.

After Helium of 92% purity was produced in Experimental Plant No. 1, the Navy, acting for the Army and Navy, entered into a contract with the Linde Company for the erection of a large production plant at Fort Worth. Latest figures on the cost of producing Helium in the new production plant, as estimated by the Navy Department, which is in charge of its operation, show that 94.5% Helium costs $150.01 per 1,000 cubic feet, and 99% Helium as $280.12 per 1,000 cubic feet.

Helium provides the United States with a weapon of warfare which is apparently not available to any other nation, because nearly all of the practical supplies of Helium so far discovered are contained within the borders of this country. On account of the anticipated further reduction in the cost of this product below the present figure, it would seem advisable that the Government should not relax its endeavors to further the exploration and development of this gas, for with an adequate supply of Helium the future of the airship in this country would be assured.

The average production of Helium in this country at the present time is such that, when compared with the production figures in the past, it would indicate that Helium production is making encouraging progress.

One of the most important problems that will have to be solved in connection with the use of Helium in lighter-than-air craft is the question of its loss by expansion and consequent valving. Due to the excessive cost of this gas, a more radical departure will have to be made in the method of handling the gas pressure than obtains at present with automatic valves in Type R balloons and airships. The Navy is preparing to conduct aerial experiments with Helium in an airship of the C Type, and the U. S. Army Air Service will do likewise upon the completion of the airship that is being designed particularly for the use of Helium.

With regard to the repurification of Helium, the Army Air Service has two plants under construction for conducting this work—one the Railroad Repurification Plant in Washington, and the other a stationary Repurification Plant at Langley Field, Hampton, Va., both of which are under the jurisdiction of the Bureau of Mines.

The Railroad Repurification Plant at Washington is now approaching completion, and consists of two cars, one utilized for producing power for the operation of the apparatus contained on the other car. This apparatus, through the process of refrigeration, absorbs the impurities (consisting principally of air) contained in the Helium. The capacity of this plant is approximately 2,000 cubic feet per hour. Being built on standard railroad cars, the plant is capable of being transported to any section of the country upon short notice. It is intended to utilize it for the repurification of Helium in use at isolated stations where it is inadvisable to locate permanent repurification plants, the impure Helium at these stations being allowed to collect for a period of six months or so, stored in cylinders, and is then repurified upon the annual or semi-annual visit of the Railroad Repurification Plant.

The plant at Langley Field, Va., which was designed and developed for the Army Air Service by Dr. Harvey M. Davis, Mechanical Engineer, Harvard University, has a capacity in excess of 2,000 cubic feet per hour, and the method used is the

(Concluded on page 207)

INFORMATION FOR PILOTS, GIVING THE PRACTICAL CHARACTERISTICS OF THE LAND ALONG VARIOUS AIR ROUTES

South Dakota

CRAWFORD to MINECARTA, choppy to rough, safe alt. 3000′ MINECARTA to HOT SPRINGS, very rough, trees, rocky, etc. Bad Lands, air bumpy. ALLIANCE, Nebr., to SCOTTS BLUFF mostly level, cap rock at Bluff. This place and GERING, Nebr., all under irrigation.

Territory of South Dakota east of the Missouri River is about the same as North Dakota. It is especially adapted and offers any number of suitable landing fields in case of forced landings.

South Dakota may be well described as North Dakota has been covered, as the fields are large, often being one mile square, and the fences are few, with practically no trees in some parts of the state. It is one vast prairie.

Western half of South Dakota—open and rolling, but plenty of good landing fields. Mostly grazing land.

Entire eastern part, to 150 miles west of Minnesota line is all excellent. The best all-round flying land in the country. No obstructions except a lake here and there.

At SHERMAN, S. D., there is a wonderful landing field at the very north edge of town, and one right across the road south.

Central western South Dakota is all quite good, lots of good fields.

Tennessee

MEMPHIS to TUPELO, see MISS.

That portion of Tennessee on a line from MEMPHIS to CLARKSVILLE is rolling and in lots of cases, very hilly. The same thing applies to that portion of Kentucky, CLARKSVILLE, Tenn., to LOUISVILLE, Ky.

Western Tennessee is fair, but farther inland it is quite difficult to find any place to land.

Western Tennessee—a rolling wooded country. Stretches of woods along rivers, 15 miles or so across. Much cotton, and hidden stumps. The fields are small and the ground washes easily so there are many gullies. A few good fields for slow landing planes, but none for fast ships. Some years some of the cotton fields are planted to grass and this makes more fields.

As a rule a forced landing here is a crash. Suggest landing within cotton rows, even with moderate cross wind. The sand bars along the Mississippi are many of them safe for landing.

Good fields—Driving Park, Memphis. Park Field—30 miles No. of Memphis.

Generally, no place for a ship.

Texas

Risk of being unable to find a good landing field in Texas is very slight. Whole state is really one big landing field. In the southwest corner around ALPINE and EL PASO it is mountainous, but if one avoids mountains and keeps to the valleys, cross-country flying is comparatively safe.

MARSHALL to FORT WORTH. Timber and hilly at start and first thirty miles, then more level, more timber patches and open patches, then less timber, more farms, cotton patches, etc. Air gets poorer, especially in summer. Near FORT WORTH several good landing places, safe alt., as follows, 4000′ start, 3000′ centre, 2000′ end.

MARSHALL Air Line to HOUSTON, one very bad strip shortly after start about 15 miles all timber, rough, no landings, then gets line on to FORT WORTH, only more level nearing HOUSTON and air better. Houston, Normana, Beeville, Kingsville, all good flying, mostly level, few timber strips, air good, watch irrigation ditches, also winds from coast, Corpus Christi section.

FORT WORTH to DALLAS, large hilly section, safe altitude 4000, not much timber, farms, etc. DALLAS, pretty good, some good landing places, small tree patches, some hilly country, some farm patches, air good in winter, bad on low power, extra hot weather.

DALLAS to WACO, about same as DALLAS-FORT WORTH, safe alt. 3500. WACO to CRAWFORD, mostly farms, open on sort of tableland. WACO air not good in summer. WACO to AUSTIN, first half, as above, gets rougher near AUSTIN, to very rough altitude first 3500′, centre 4500′ and last 5000′. Only one safe place to land AUSTIN. Hilly rocks, some timber. AUSTIN to SAN ANTONIO, via TYLER. As above start, leveler after twenty miles, more timber level and small hills, with considerable timber TYLER. Alt. 3500′, this changes into MESQUITE upon approaching SAN ANTONIO, with creeks that are rough, rest level. South of SAN ANTONIO, rocky mills. East, lake, Mesquite, west Mesquite to timber, and rough.

FORT WORTH to TEXLINE. FORT WORTH to HENRIETTA, hilly to level, farms, less trees, air lighter. HENRIETTA to WICHITA FALLS, more level, about same. Safe alt. 2000′.

WICHITA FALLS to BERNON, about same, alt. 2000′. VERNON to CHILDRESS, gets rougher, red clay hills, safe alt. 2500′. CHILDRESS to MEMPHIS, gets rougher, more chop hills, air lighter, fewer landing places. MEMPHIS, Tex., to CLARENDON, cross RED RIVER breaks, bumpy red clay hills first, then more rolling oil bumps. Safe alt. 3000′. CLARENDON to CLAUDE, becomes level prairie. (Note—all along the ed River are breaks and rough), also from there way east to Memphis, over into ANTLERS, OKLA., country is rough, hilly, coal mines, this is on north bank. CLAUDE, Tex., to AMARILLO, same, level, air light. AMARILLO to TASCOSA, becomes rougher, breaks of the CANADIAN RIVER, safe alt. 3000′.

TASCOSA to CHANNING, rough to rolling, some sand hills. CHANNING to DALHART, rolling to nearly level, some plateau land with bumpy "crevices." DALHART to TEXLINE, high level prairies. Air light, unsafe, puffy hot day DALHART to TEXHOMA, via Stratford—same as above, only more level, slightly better air. TEXHOMA (Okla-Tex.) to AMARILLO, via DUMAS, Tex. Rolling long prairies, DUMAS level, south enter patches of sand hill, then bad breaks of CANADIAN RIVER, then rough rolling to level upon arrival AMARILLO. Air only fair, bumpy over Canadian breaks most all time.

AMARILLO to TEXOLA, via Pampa, Canadian, Miami. To Pampa rolling to level, to Canadian gets rougher, more hills and timber, cap rock. To Miami very rough. Cap rock to TEXOLA via SHAMROCK, becomes more level. SHAMROCK is hilly, TEXOLA slightly. Not much timber, air slightly better, windstorms. AMARILLO to TEXICO, via HEREFORD, much timber. FARWELL, mostly level to rolling, one small canyon to cross and cap rock. Safe alt. 1000 feet. AMARILLO to LUBBUCK via Canyon, level, rough Canyon, rolling to level, some trees, air fair. LUBBUCK to PLAINVIEW, mostly level. PLAINVIEW to FLOYDADA, same, farms. FLOYDADA to SILVERTON, some rolling, mostly level. SILVERTON to TULIA, same, some hilly TULIA. TULIA to PLAINVIEW, via Happy Level. TULIA to AMARILLO, mostly level. AMARILLO to TUCUMCARI, N. M. To Veja level, then rolling, then breaks; then upon approach to Tucumcari, rough. Thence to SANTA FE, gets very rough. Spur, fairly level, Matador, hills to level. Stamford, same. New Braunfals, timber, poor flying. Farwell, level. El Paso, rough, Fort Bliss, rolling. Rule, half level, part rolling.

From TULSA, Okla., to FORT WORTH, Tex., is all good territory. Almost the entire northeast section of Texas is good. On a line from FORT WORTH to SHREVEPORT, La., the country gets bad from Mineola, Texas, east.

Texas is very good. Government fields are very numerous here.

Texas as a whole, excepting East Texas, is very good country for cross-country flying. A pilot can nearly always find a place for a forced landing. Air lines between HOUSTON and DALLAS, and HOUSTON and SAN ANTONIO are good. Between HOUSTON and SHREVEPORT, La., a pilot will find much wooded country and places for forced landings few and far between.

The air in western Texas is none too good for a novice to work in.

DALLAS is due south from OKMULGEE, Okla., and it is a regular air route, lots of good fields. LOVE FIELD in Texas is an army field.

Texas is the best state in the Union for cross-country work. Seven complete Government aviation fields, two of them being double-unit fields, were located in Texas because of the admirable climatic conditions and because of the flat country extending over most of the state. From the Gulf to the North State line, and from the East boundary to a North and South line intersecting SAN ANTONIO, with the exception of a few hundred square miles in the central part of East Texas, all of this territory covered has abounded with good fields and much open country.

Practically all of the excepted portion mentioned is thinly settled, seldom flown over and has no town of sufficient size to warrant an aviator in there locating. So it is almost a surety that no application for coverage will be received from that section of the state. Any other portion of the state, within the boundaries mentioned, is a safe risk.

Along the Gulf Coast of Texas, ranging from ORANGE to GALVESTON, and extending inland for about twenty miles, is a marshy, swampy stretch of land, but a landing in it would only entail difficulty in removing the plane, or possibly a broken propeller. It is treeless, but has high grass. However, all of the travel along the coast line given is done along the edge of the Gulf, which gives a constant landing field in the form of a good, wide sand beach.

From ARKANSAS CITY to WOODWARD, Okla., all country south of this to WACO, Texas, is open and wonderful country to fly over and very flat, with the exception of a little string of mountains that run west from FT. STILL. These mountains are low and about two miles across in the widest place. From WACO, TEXAS, to HOUSTON, following the Brazos River is very good, but a lot of timber is on either side of the river, especially on the east.

Texas is good between GALVESTON and MEXICO—level. North of Houston 30 miles a stretch of woods to the N.E. that appears to be solid, to ALEXANDER, La., and for a long ways north of HOUSTON. It is open southwest and northwest of Houston. To the east one has only a few 10-mile stretches of timber between HOUSTON and BEAUMONT. It appears to be solid timber, north of BEAUMONT. All along the Gulf from south of CROWLEY to GULFPORT, Tex., there is a good sandy beach, no timber, but with some floating bog near ORANGE, Texas.

Country between VICTORIA and HOUSTON, fair. AUSTIN, a little hilly. BATON ROUGE CO. mostly river and sugar cane. All rice fields have ditches and most of the year or except in fall, are very soft. There is much timber in this section. An open space extends from ALEXANDER as the tip of the triangle with KINDER and LAFAYETTE, as the base, mostly rice. From CROWLEY south and west it is all open but *mostly* rice. This rice belt extends to BEAUMONT, TEXAS. One can avoid the timber by following R.R. tracks and although it is mostly woods between New Orleans and Lafayette, a slow ship could find a few places to land. There is no field near New Orleans.

Vermont

There are many recognized landing stations in Vermont, which makes that state good. Routes running into this state are comparatively safe going. One of these routes is to follow the Conn. River to BURLINGTON. Most of the country any distance away from established air routes here is hazardous, very risky to fly over.

From RUTLAND to KEENE, N. H., passing through GREENFIELD, Mass., is a good route to follow, if a reasonable altitude is kept.

Virginia

Western part of state very mountainous; rough country starts 15 to 20 miles east of LYNCHBURG: central part of state fairly open, though there are large sections of timber land there. Eastern part of state near NORFOLK, much timber. Between NORFOLK and LYNCHBURG first 25 to 30 miles, very few open fields.

From DANVILLE to ROANOKE, mountainous, no chance for landing except in vicinity of rivers. ROANOKE to LYNCHBURG, mountains land near rivers. LYNCHBURG to DURHAM, N. C., very hilly country but landings can be made with luck.

On the route from WASHINGTON through LYNCHBURG, Va., and on south, conditions are very good for a flyer to travel around 2,000′ elevation. On route from NORFOLK through LYNCHBURG, the conditions are ideal until one reaches this city flying at a thousand or fifteen hundred feet. Going west from LYNCHBURG, an altitude of three to five thousand feet is advisable as one progresses west. There is a field outside of Lynchburg that has a peculiar cross current at the lower end, caused on account of a ravine and a clump of trees, on other side; two pilots broke their undercarriage propeller and one wing not thirty feet from one another.

Striking south and west from Langley Field, Va., across Chesapeake Bay, following the Atlantic Coast Line R.R. through NORFOLK and on through Suffolk into North Carolina to RALEIGH, the terrain here is very poor; no landing fields at all for about fifty miles. Then one begins to see small plowed fields and pine trees, with only an occasional green field, few of which could be landed in with any degree of safety.

Along the route Greensboro to Langley Field through Virginia, conditions are a little better. Along the Southern R.R. to DANVILLE, Va., thence the eastern branch of the Southern through Clarksville, Lawrenceville, Franklin, Suffolk, Norfolk. Landing fields are not numerous, but they can be found here and there if one flies at about a 4,000′ altitude. There is an excellent field at Franklin, Va., at the intersection of the Southern with the Seaboard Air Line. It is quite large and smooth, and there are a number of other good fields in the vicinity.

Generally no place for fast ship, though J.N's can find some fields.

Washington

Country around SPOKANE varies considerably in character. Taking an arc due west of SPOKANE to a line southwest from Spokane, the land between this city and the COLUMBIA RIVER is a very fine section to fly over. It is flat agricultural land, found in large fields from quarter sections to sections.

COLUMBIA RIVER—there are some low ranges but from 5,000′ to 6,000′ altitude a ship can safely and easily glide into YAKIMA and ELLENSBURG VALLEYS. The former is flat, but found in small tracts; the latter is open but more rolling. From YAKIMA and ELLENSBURG to the coast is across the Cascades and is suitable for high altitude trips. The best route to the coast from SPOKANE is above PASCO and down the Columbia River to PORTLAND. The western half of this is not so good. Fields are very few and small.

Swing from the southwest to the south, it includes the SPOKANE and WALLA WALLA route. The country is still open but becomes more rolling. The best landing fields being on the high ground and sometimes on slopes, but this calls for landing up-hill rather than to the wind. From WALLA WALLA south to BOISE, Idaho, is rough and hilly, timbered country. East and north from SPOKANE, country is mountainous and heavily timbered, the worst kind of flying country; only the SPOKANE VALLEY west to COEUR D'ALENE and the COLVILLE VALLEY north to COLVILLE is ideal territory to fly over.

THE INLAND EMPIRE consists of that territory lying between the two ranges of the Rockies; The Cascade Range on the west, which is about two hundred miles from SPOKANE, and the Bitter Root Mts. on the east, which are about forty miles away. On the north there are valleys formed by several low ranges of mountains which extend south from the line. One may land almost anywhere in these valleys. On the south as far as the Oregon Line is a rolling wheat country.

All of this Inland Empire lies at an altitude varying from 1,500′ to 2,500′ above sea level and except on the mountains, there is practically no wooded land and not much rocky country. In general, one could describe this whole territory as rolling wheat land, with emergency landing fields everywhere. During the past year there have probably been fourteen forced landings made by either pilots or private owners operating out of a field owned by a large company here. All of these landings were without accident or damage to the plane.

The usual routes of air travel in Western Washington are as follows:

From SEATTLE to BELLINGHAM by way of EVERETT or SNOHOMISH and MT. VERNON to BLAINE; or across the south to VICTORIA, B. C.

From SEATTLE or EVERETT across the SOUND to PORT ANGELES and PORT TOWNSEND.

From SEATTLE to TACOMA, thence to CENTRALIA; from CENTRALIA to KALAMA, thence to PORTLAND, Oregon.

From SEATTLE to GRAYS HARBOR by way of TACOMA and OLYMPIA; sometimes calling at CENTRALIA or CHEHALIS.

From SEATTLE eastward the common route is to Cle Elum by way of SNOQUAIMIE, NORTH BEND and SNOQUAIMIE PASS, thence to YAKIMA by way of ELLENSBURG, or to WENATCHEE direct from Cle Elum or to WENATCHEE from ELLENSBURG.

During the season from June first until November first landing places can be found on all of these routes west of the mountains; but for the remainder of the year most of such landing places, with the exception of the vicinity of TACOMA, are very wet and some of them even under water. From Cle Elum eastward, landing places can be found the year round. From Seattle to Cle Elum the only available landing places are small cleared fields which are under cultivation, and would not ordinarily be considered as available at all in more favored sections of the country. This route also crosses the Cascade Mountains.

Landing places are easily accessible on practically all routes east of Columbia River; but the great difficulty encountered in Eastern Washington is not the matter of adequate landing facilities but air conditions are unfavorable to low-powered machines, due to the barren nature of the country and the high temperature encountered there during the summer months.

West Virginia

From YOUNGSTOWN, Ohio, to PARKERSBURG, W.Va., via MOUNDSVILLE, W. Va., fair for 25 miles out of Youngstown until strike Ohio River; then very bad to Moundsville. Good field there but high hills on both sides. A pilot should be on the look-out here, as a ship was wrecked here by hitting a very high wire and there are high poles. After leaving here, a forced landing can be made on a small island in the river near SISTERSVILLE; it does not look good from the air but it is a very good field. The entire country all down this valley is rolling and shows no good fields. At PARKERSBURG the country is just fair.

Wisconsin

Western Wisconsin on the line from the Twin Cities to Chicago is very bad and dangerous flying country.

Southern Wisconsin is good but parts of the eastern and central country are bad, hills and trees. Very uncertain air has been encountered there, especially when flying low, probably due to the roughness of the ground.

From CHICAGO to MINNEAPOLIS-ST. PAUL, over LA CROSSE, Wis., the route lies over fairly level and open territory as far as the Wisconsin River, from there on northwest the country grows rapidly rougher and with heavy timber till the last fifty miles out of La Crosse has only scattered possible landing fields. From La Crosse up the river valley or over the highlands to the west of river, possible landing fields are available from an altitude of two to three thousand feet. The territory from the Wisconsin River northwest has days when low fog and rain make it impassable but these days are actually not numerous. In winter time this route suffers from very cold weather and blinding snow storms, some of which are practically impassable. This route does not suffer from prohibitive winds.

The route between MILWAUKEE and CHICAGO, and MILWAUKEE and GREEN BAY is almost ideal from an emergency landing field point of view. The most level field in Milwaukee County is the field 5 miles south of the Milwaukee Post Office and 1½ miles west of Lake Michigan.

One route from Milwaukee to Chicago follows the C. M. & St. P. R. R. as far as RACINE, which is past two miles west of the City Hall. KENOSHA is past 2½ miles and WAUKEGAN 3 miles. Land at the Air Mail Field at Maywood, Ill., also known as the Checkerboard Field. All along the route there are many level fields which have ample landing facilities. The country from Milwaukee to Green Bay is almost similar although slightly wooded in small sections.

The southwest corner of Wisconsin—Grant Co., quite hilly and bad; also Lafayette and Iowa. Green Co., good—Dane Co., good—Rock Co., good, and so is whole S. E. corner; up around Portage it gets poorer. Monroe, Juneau, Adams, quite good—Jackson Co., very poor. Eau Claire is a bad town to fly out of. Dunn Co. quite good, and generally the country east of St. Paul is very spotted. Some good and some quite bad.

Wyoming

SCOTTS BLUFF, Nebr., to CHEYENNE, Wyo., level to rolling, safe alt. 2000', bad snow storms in winter months, sudden; air fair. CHEYENNE to SHERIDAN, mostly mountainous, unsafe "Little Big Horn Mt."

Bighorn to Sheridan, rolling, safe alt. 3000', air bad. Sheridan to Dayton, rolling, quite a lot irrigation at Dayton. Sheridan, to Ranchester, gets rugged, rolling. Sheridan to Crawford, Nebr., rolling, a couple five-mile divides, air bad. Sheridan, fair at Crawford.

Valentine to Thedford, valleys with strips of sand hills, safe alt. 3000', air fair. Thedford to North Platte, sand hills.

From Colorado Springs, Colo., to Cheyenne, Wyo., a short flight of two hours, is over flat country with the exception of only a small range near Colorado Springs.

The eastern half of this State is ideal flying country, practically one large landing field—rolling prairies, the greater part of it never having been broken, and the fences are few and far between. The western half, however, is mountainous and hazardous.

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A MOST interesting lecture, to which the members of the Club were invited, was delivered at the Franklin Institute on October 6th on Aeronautic Research by Joseph S. Ames, Professor of Physics, The Johns Hopkins University and Director, Office of Aeronautical Intelligence, National Advisory Committee for Aeronautics. Three types of aircraft were described: the aeroplane, the airship and the helicopter, and the explanation of their power to fly was given. The principal scientific problems arising in connection with the various types were stated and the method of solution described. Attention was called to the importance of both wind-tunnel experiments and actual flying tests.

The lecture, being fully illustrated by lantern slides, was most entertaining and a large audience was in attendance. The courtesy extended to the Club whereby the members are enabled to attend these lectures is much appreciated and the thanks of the Club is given to The Franklin Institute for the invitations which have been sent the members.

Representatives of the Industrial Relations Committee of the Philadelphia Chamber of Commerce flew to Washington on September 22nd, where they were received by President Harding. Comfortably seated in the large Fokker monoplane, the party of six passengers left the Bustleton field shortly before nine o'clock and arrived at their destination two hours later. The large plane, known as the "Half Moon," is of the enclosed cabin type with separate seats for the occupants, also a luggage compartment. It was piloted by Bert Acosta, a chief test pilot during the war.

"We had an excellent trip," said Acosta. "We flew low and everybody enjoyed the scenery. The weather was clear, permitting a good view of the country. The ladies particularly expressed their delight at flying, and remarked on the comfort as well as the thrill it afforded."

The large plane created much interest during its stay in Philadelphia, being of a new type and construction, the wings being covered with plywood instead of fabric and of the cantilever form without any external wires or bracing. It is hoped that some time in the near future Philadelphia will have a landing field of sufficient size to permit these commercial planes to readily land within the city limits close to transportation to the central parts of the city instead of being forced to the small unsuitable emergency fields on the outskirts.

The new six-passenger flying boat constructed for the Secretary of the Navy at the Naval Aircraft, Philadelphia, left its hangar on September 21st for its initial trip to the Navy air station just across from Washington, where it will be kept subject to the order of Secretary Denby. It was piloted by Commander Richardson and Lieutenant McFall of the Navy Aircraft Division, who were accompanied by four naval officers as passengers. Its total capacity is ten.

The machine which is very similar to the standard navy F5L type, has a span of 105 feet, weighs 14,000 lbs. completely outfitted, and is equipped wtih two Liberty motors and has a speed of from sixty to ninety miles an hour.

Ample space has been provided in the machine for passengers and crew. There are two compartments, one a large observation and pilot room with port holes and the other a well furnished cabin with chairs and table.

The funeral of Lieutenant Wistar Morris, war aviator, whose body arrived recently from France, was held with military honors. Lieutenant Morris was a sophomore at Princeton at the outbreak of the war. He enlisted in the 12th Aero Squadron, which trained at Princeton, and went to France in the fall of 1917. During the following year he made a splendid record flying on the western front. He met his death September 29th, 1918, when his plane was brought down in the enemy lines by German anti-aircraft guns.

A most cordial invitation has been extended by the Philadelphia Section of the American Society of Mechanical Engineers to the officers and directors of the Club to be present at the meeting of November 22nd as guests of the A. S. M. E. This is the annual smoker and get-together meeting of the Philadelphia Section and will be held at the Adelphia Hotel (Roof Garden). The speaker of the evening will be Commander H. C. Richardson, U. S. N., his subject being "Experiences on the NC3 during the Trans-Atlantic Flight."

A real "old time" meeting of the Club will be held at the headquarters, 1026 Walnut St., Philadelphia; evening of October 21st, at 8 P. M. This is to be a regular get-together meeting of old and new members, past and present officers, and a fine time is anticipated. At 6.30 P. M. a special dinner will be served to the members, who should advise in advance so that proper reservations can be made.

Major Joseph A. Steinmetz, president of the Club, has just lately returned from overseas and is to be the dinner guest. At the meeting he will tell all about what is doing in aviation in Europe and will have on display some interesting air mail letters from his historic collection. There will be reports of Committees and other matters for the consideration of the members.

The attention of all who are interested in aviation is again called to the fact that the meetings of the Aero Club of Pennsylvania are held at the Club room, 1026 Walnut St., the third Friday evening of each month, and that they are cordially invited to attend and join in the discussion of the aeronautical topics held by the members. Come to the meetings and get acquainted and make application for membership.

W. H. Sheahan,
1st Vice-President.

NAVAL and MILITARY AERONAUTICS

Airship C2 at Aberdeen

Through the efforts of the Ordnance Department of the Army, an airship hangar of sufficient capacity to house a C-Type airship of approximately 108,000 cubic feet of gas capacity and having a useful lift in excess of 2.000 pounds at bombing altitudes, has been erected at Aberdeen, Md. At the present time the Ariship C-2 is housed in this hangar and is successfully operating therefrom. A suitable bombing rack and suitable sights are being installed on this ship for the dropping of bombs up to 1,000 pounds in weight.

The purpose of the Ordnance Department in requesting the assignment of this ship to Aberdeen was to carry on extensive tests with bombs. Being able to hover and thereby capable of making a very high percentage of hits, the airship in this respect is superior to planes which have heretofore carried out experimental bombing with large sized bombs.

Movement of Air Service Troops

Orders have been issued relieving the 1st and 5th Squadrons, Air Service, from temporary duty at Langley Field, Va., and directing their return to Mitchel Field, Long Island, N. Y. These two squadrons present 6 officers and about 75 enlisted men.

Assistant Secretary of War Visits Camp Knox

Assistant Secretary of War Wainwright, on September 19th, inspected the 31st Balloon Company at Camp Knox, Ky. This was a tactical inspection, the balloon being in the air, and the men were inspected in their tactical sections. At the conclusion of the inspection, the Assistant Secretary went aloft with Lieutenant Farnum to look over the camp. A 20-mile trip was made, and a comprehensive study of the territory was reported.

Training 170 Flying Cadets

The Air Service has been authorized to make preliminary arrangement for the securing and training of 170 additional flying cadets. Sufficient money is available out of the current fiscal year's appropriations to provide pay for that many and other expenses incident to their training, and there is sufficient aeroplane equipment. The only difficulty lies in the lack of funds for transportation of the candidates from their homes to the flying training centers. The Air Service is informing those who have made application for the training, and it is expected by January 1, 1922, or soon thereafter, funds will be available for their transportation.

Free Balloon Flight Over Manila Bay

Floating in Manila Bay for over two hours in an almost submerged basket, with a half-inflated balloon acting as a sail and dragging the basket through the water at the rate of about ten miles an hour was the exciting experience of a party of three aeronauts who attempted a free balloon flight from Corregidor Island to Manila on August 10th last.

An interesting report covering this flight has just been received from Lieutenant W. A. Gray, Commanding Officer of the 27th Balloon Company, stationed at Kindley Field, Fort Mills, P. I., who was the pilot of this balloon.

The equipment used for this flight was an old leaky Type R balloon, which had been condemned as unserviceable for observation purposes, and a basket equipped with Kapok flotation rings. The purpose of the free balloon flight was to give the observers practice both in handling and landing a Cacquot type balloon in case of an accidental breaking of the cable.

In about a ten-mile breeze blowing towards Manila City, the balloon "weighed off" at 9:25 a. m., with 12 bags of ballast, the crew, in addition to Lieut. Gray, the pilot, being Warrant Officer R. E. Lassiter, aide, and Captain I. H. Edwards, 2nd Aero Squadron, passenger. When about five miles from Corregidor, the wind died down entirely and numerous clouds were encountered at an altitude of two thousand feet. Whenever a cloud would pass over the "bag" and cool the gas—in addition, the cooling effect of the water at an altitude of six hundred feet had also to be considered—the balloon would then descend rapidly, necessitating using ballast. Approximately, after five minutes of a cloud the sun would appear and the balloon would then ascend rapidly until the automatic valve would function, thus causing the "bag" to again descend to where some other clouds would be encountered, causing further descent. It seemed impossible to get and maintain an equilibrium, which was possibly due to the weather conditions, the automatic valving and the porous fabric of the balloon. In addition to this, more ballast was used than actually necessary, due to the fact that the only instrument used was an altimeter, which was at least 200 feet slow in registering.

About an hour and a half after the beginning of the flight the balloon was in the middle of Manila Bay, some eight miles north of Corregidor, and it was seen that the ballast would not hold out much longer. Preparations were therefore made for coming down in the Bay. The inside lining of the basket was ripped out, in order that when landing the water would not force it up and throw the passengers out. Meanwhile, the occupants of the balloon undressed. After two hours and fifteen minutes in the air, and with only one bag of ballast remaining, the balloon slowly descended and the basket landed in the water. The drag rope, weighing about sixty pounds, was still rolled up and tied to the basket, but as soon as the basket hit the water it was cut off altogether. No sooner was this done than the balloon began to ascend again. The valve rope was pulled, stopping the ascent when an altitude of 400 feet had been reached. Again the balloon descended and with the remaining bag of ballast an excellent landing was made. The balloon still had a large quantity of hydrogen, only the tail being in the water, and, as there appeared to be no danger of it falling and enveloping the basket, the rip panel was not pulled. The water meanwhile was within a foot of the top of the basket and just below the flotation rings, but it was apparent that the hydrogen remaining in the top of the balloon was what actually kept the basket afloat.

It was fully believed that the plight of the balloon could be easily seen from Corregidor, so that no anxiety was felt for the first forty minutes. When, however, no boat was seen leaving the island, it began to appear as though no help was to be expected from there. There were several small fishing smacks about a quarter of a mile from the balloon, and although repeated signals were sent to them they did not respond. After about an hour and a quarter of aimless drifting, a breeze blew up, and the half-inflated balloon acting as a sail began pulling the basket through the water at the rate of about ten miles an hour. When the basket began moving, one side of it went under water, but all concern as to safety vanished, for with the wind holding out it was only a question of time before Manila would be reached. After being in the water about one hour and fifteen minutes, a boat was seen to leave Corregidor, and one hour later, or at about two o'clock, this boat picked up the balloon, basket and passengers, fifteen miles from Corregidor. It is estimated that about six miles were covered in sail boat fashion.

The results of this flight were more valuable than if Manila Bay had been crossed and land reached, as it proved that there is not any danger in a balloon of this type falling on the basket when landing in water and that, so long as any hydrogen remains in the "bag," it should not be ripped. This flight also demonstrated that when flying at this station baskets should be without an inside lining and should be equipped with flotation rings, or life preservers, and two straight bladed knives.

Helium for Airships

(*Concluded from page* 203)

liquefaction of impurities from the Helium. Dr. Richard B. Moore, Chief Chemist of the Bureau of Mines, is in charge of this plant, assisted by Mr. Ferris of that Bureau, the latter being stationed at Langley Field. The plant is operated in conjunction with the hydrogen plant at this station.

It is anticipated that both the Railroad Repurification Plant and the plant at Langley Field will be ready for operation about the first of next year. The successful operation of these plants is assured, inasmuch as the laboratory designs which have been tested out have proved very successful.

FOREIGN NEWS

Railway Survey by Air

There can be no question but that the aeroplane and the airship can render immeasurable service to civilization by the rapidity and certainty with which they can open up communications in unsettled country, and by ground surveys of tracts across which it is desired to establish roads and railways in virtually unknown and unexploited lands. Already a great deal has been accomplished in Canada and other sparsely populated countries by way of forest surveys, which have brought in a few days information and knowledge which it would, without the assistance of aircraft, have taken months to gather, even if it were possible at all. Fresh ground is now being broken in Australia by an explorer, Mr. Francis Birtles, who has undertaken an aeroplane journey across the center of the Continent. His route takes him from Adelaide north to Oodnadatta and thence to Alice Springs, which lie at the foot of the Macdonnell Range almost in the center of Australia. He is to keep a lookout en route for pastoral, agricultural and mineral areas, and is to carry out a rough aerial survey for the best route for the proposed railway from the south to the north of the Continent. He is also to fly across the inland sea known as Lake Eyre, where it is believed there may be fertile islands. He expects to gain in five weeks more information than could the best equipped land exploration expedition in a year.

We do not doubt for a moment but he will. So far, we have very little to guide us in the way of actual survey work of the kind upon which this Australian air explorer is now engaged. But we have the records of many difficult reconnaissances of almost similar character carried out during the War in the remoter theatres of hostilities. East Africa and Mesopotamia provide many such examples of excellent work done and valuable information regarding the terrain obtained by officers of the flying services. Almost invariably this information was greatly more reliable than the best maps obtainable, and this quite often in districts which have been at least partially surveyed from the ground. This being so, there is every reason to believe that such cases as the Australian survey now in progress will result in sufficiently accurate data being obtained to enable the authorities to decide upon the route for the Transcontinental railway without going to all the expense, trouble and delay of carrying out a detailed ground survey on more orthodox lines. What this means in the quicker opening up of the country to civilization and settlement is too obvious to need laboring. On the face of it, a year will be saved in getting to work, and in such enterprises as that contemplated a year counts for a great deal. And the aeroplanes and the airship—for both have their distinct spheres of usefulness in such tasks—are only now beginning to demonstrate their possibilities in this direction. We can safely look forward to the time when all preliminaries of survey work for the opening up of new countries will be accomplished by the aid of aircraft. The aeroplane will be followed by the airship, carrying a survey party whose duty it will be to dot the i's and cross the t's of the first survey. The saving of time and money will be enormous, let alone the saving expressed by the bringing into production of new areas and fresh countries.

Conquest of Arabian Desert by Aircraft

Heretofore the Arabian Desert had been regarded as a bar to direct communication between the Mediterranean and the Persian Gulf. Aeroplanes, instead of crossing it, flew on a semi-circular course round its northern extremities, and so covered many more miles than actually separated the aerodromes on its eastern and western sides. The length of the new route is 580 miles, and the line it follows passes through Amman in Transjordania and Kasrel Azrak, where there are now landing grounds, and then in an almost straight line crosses the Arabian Desert to Ramadie on the Euphrates and leads thence to Baghdad.

The Royal Air Force have carried out the survey. They had the cooperation of the Emir Abdulla in establishing at Amman an advanced base 45 miles east of Jerusalem. There in May was assembled a flight of aeroplanes, armored cars lent by the British War Office, and desert tenders fitted out with wireless telegraph apparatus.

The locating of the first 150 miles of the route was done with little difficulty. Then the ground parties began to find their work more and more toilsome, until 160 miles from their starting point they struck a vast tract of rough lava beds. Scattered across this tract, which was intersected by deep wadis, were enormous boulders. But a way out of the lava bed had to be found, and when those working on the level were well nigh baffled, and when the growing heat of June added to the hardships under which they labored, news at length came by wireless from the scouting aeroplanes far ahead that a way out of the wilderness of stone and dry stream beds had been found. That was on June 16th. The ground parties forthwith set to work anew and forced a passage through 10 miles of heart-breaking country out into the desert again, where they struck land that was comparatively easy to work. Four days later ground connection was made with Baghdad when the cars arrived at the emergency ground at El-jid, 300 miles from Jerusalem. Operations were pushed on from the Baghdad side, and on June 25th Ramadie was entered by air and land. Baghdad was entered on the following day.

Thus the route was roughly laid out. Work is now going on in perfecting the emergency landing grounds, and in making permanent the ground organization along the track.

Japanese Activities

Japanese newspapers report that the Army Balloon Corps will participate in the maneuvers with the Imperial Guards Division at Suson near Mt. Fuji from September 12th to the 15th. The R model captive balloon will be used for observation purposes. Five officers of the Balloon Corps and several additional observation officers will take part.

Ten civilian aviation students at the Army Flight School at Tokorozawa graduated August 31st. This is the first civilian class at Tokorozawa, but it is expected that these classes will be continued regularly in the future.

A small, non-rigid type airship was recently purchased by the Japanese government from the Vickers Company, London. The airship performed its final test of four hours continuous flight on April 27th, successfully, only 30 men being required to handle it, and it ascended and descended very rapidly. The airship is described as having one "ship" in the center, capacity 5 men, and with a speed of over 50 miles per hour.

The graduation flight of the Naval Air School at Kokosuka took place on July 10th. The course was from Oppama (near Yokosuka) to Shinmaiko and return, six graduates taking part. Only one machine reached the latter place, the other planes being forced to descend into the sea. Bad weather conditions prevented this one plane from attempting the return journey.

Lisbon-Paris Service

A regular daylight aeroplane service between Paris and Lisbon is announced by the Portuguese Company of Aerial Navigation for this winter. Next year it is proposed to extend the line to London, Brussels, Amsterdam and Berlin.

The Germans in the Netherlands

Advertisements recently appeared in the leading Dutch newspapers offering for sale 36 new German aeroplanes, of which eleven are said to be ready for immediate use. The advertisements state that the machines are equipped with 200 h.p. Benz and 120 h.p. Mercedes engines, and that all spare parts are also available.

Swedish Aero Show in 1923

According to *Svensk Motortidning* it is intended to hold an Aero Show in Göteborg, Sweden, in 1923. The time tentatively fixed for the exhibition is July 7-31. It is stated that the Society of British Aircraft Constructors and the Chambre Syndicale des Industries Aéronautiques have been approached on the subject of participation in the exhibition and have given favorable replies. It is also hoped that Italy, Germany, Czecho-Slovakia, and the United States will participate.

Australian Air Mail Services

The first of the series of Aerial Mail Services in Australia under control of the Commonwealth will be inaugurated on October 30, or if subsequently fixed by the Minister of Defence not later than November 30. While a limit of £25,000 has been placed by the Government on the total amount of any tender, tenderers are to be given the option of forwarding proposals to maintain a greater or less number of trips than is provided in the conditions-contract. Tenderers must name two guarantees to the amount of £5,000 for safety of mails and fulfillment of contract. Tenderers must specify the class of machines, and numbers proposed to be provided, with their speed, radius, petrol consumption, carrying capacity, etc. The scales of charges for passengers and freight will be subject to the Minister's approval.

Helicopterist's Accident

From France it is reported that de Payer has had an accident while testing a helicopter of his own design. The report states that something went wrong when the machine was at an altitude of about 200 metres. (Looks like a record for helicopters.) The machine did not drop at once but swayed about for nearly five minutes, the inventor evidently trying to right it. Finally it crashed and the inventor sustained severe injuries.

The Coupe Michelin

Several attempts have been made by French and Italian pilots to improve upon the performance of M. Poiree on a Caudron C. 60. Pelletier d'Oisy made a try, but had to give up at Toulouse. In Italy the coditions are more or less the same, except that Italian pilots are at liberty to choose a sea circuit for their attempt if they prefer.

The following attempts have been made by Italian competitors: Col. Armani on a B.R. had to give up after covering a little over half the total distance of 3,000 kilometres. Capt. Diziano crashed on Mount Gandino. Capt. Martinetti it appears has succeeded in completing the course, and, subject to homologation by the French Aero Club, he seems to have improved upon Poiree's performance, having covered the 3,000 kilometres in 35 hours, while Poiree took 37 h. 23 mins.

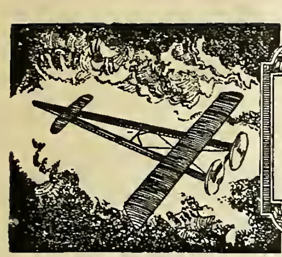
Commercial Aviation in France

During the course of an interview with a correspondent of the London *Morning Post*, M. Laurent Eynac, the French Air Minister, remarked that the development of aviation in France, especially commercial aviation, has been most remarkable lately. There are already organized six regular aerial lines for the carrying of goods and passengers and, so far as air transport is concerned, France is ahead of all other nations. In May next a new aerial line, Paris to Amsterdam, will be inaugurated.

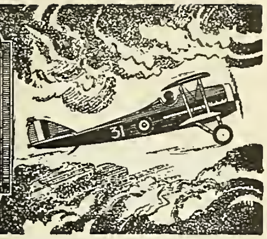
Aircraft are especially useful on account of the saving of time, M Eynac stated. Thus, it takes more than nine hours to go from Paris to London by train and boat, but by taking the aerial mail one can be in Regent street four hours after having left the boulevards. By air, Brussels is only two hours and a half from Paris, and Strasbourg only three hours and a half. Prague is seven hours from Paris and one can reach Morocco after a thirteen hours' flight, while the most rapid ship takes four days. Railways take ten hours to go from Bayonne to Bilbao; a motor-car will make the same journey in five hours, but a seaplane unites the two towns in 55 minutes.

Another factor of paramount importance to the future development of aircraft is that of security. The results already obtained entirely guarantee the security of passengers. During the year 1919-1920, 1,900,000 kilometers (1,180,603 miles) have been covered by the flight of French aeroplanes. Of this total there were only 7 killed and 7 wounded, that is to say, an average of one killed and one wounded per 170,000 kilometers (105,633 miles) flown. Consequently, it is not surprising to notice the constant development of aerial transports in France. The transport of passengers has greatly developed. Only 960 persons traveled by air in 1919; the number of passengers amounted in 1920 to 6,750. This year during the month of March 665 people traveled by air mail. The carrying of goods has similarly progressed; 13,900 kilograms were carried by machines in 1919, while the total commercial transport amounted in 1920 to 103,330 kilograms (227,739 lbs.) This last figure includes a great many parcels sent from Paris to London by the dressmakers and milliners of the rue de la Paix, who utilize the plane extensively in making their deliveries. The value of their consignments on the line Paris-London during the year 1920 exceeded 16 million francs, and this figure will be largely surpassed this year.

M. Eynac, in conclusion, states that he feels sure that aircraft will prove in the future a most important factor for promoting good entente and solidarity among the nations.



ELEMENTARY AERONAUTICS *and* MODEL NOTES



Fokker Model Built by Bruce Mapes

FOLLOWING the outlines published in the November 4th 1918 issue of AERIAL AGE and those on the model page of August 22nd, Mr. Bruce A. Mapes of Brooklyn has built one of the neatest flying scale models ever presented. As the intention was to make the model even more realistic than that shown on the model page last summer, the builder has worked into the design a great many constructional features that appear on the real plane. Naturally no attempt was made to sacrifice detail for the sake of weight, and although long flights cannot be made, the fine appearance is ample reward for the work put on it.

Here is a list of dimensions of the model:

Dimensions

Upper wing span	44⅜ inches
Lower wing span	30½ inches
Chord—upper wing	8 inches
Chord—lower wing	6⅜ inches
Gap between wings	5⅞ inches
Chassis wing span	7¾ inches
Chassis wing chord	3½ inches
Overall length of fuselage	32¾ inches
Height overall	15¼ inches
Propeller diameter	13¼ inches

Wing Construction

The wings are built up with ribs of balsa wood, the curve made to scale taken from the Fokker wing curve. There are 29 ribs in the top plane.

The front main spar is tapered and hollow, just like the full size beams used on the real machine. The spar is built up of 1/16 inch by 1 inch for the sides and 1/16 inch by ⅜ inch for the top.

Rear spar is an "I" beam, ⅜ inch by ¼ inch, tapered slightly at the ends.

Leading edge of white pine, ⅛ inch by 1/16 inch. Trailing edge is 3/32 inch round reed; the "scalloped" effect is accomplished by steaming and forming the curves.

The lower wing is made similar in construction to the upper, except that it is made in two pieces instead of one; this was done so the lower wings could be taken off easily, by means of fittings attached to the fuselage.

Both the body wing-struts and the *N struts* between the wings are made of ¼ by 5/32 inch pine, streamlined. Simple U fittings, attached to wing spars, permit the struts to be removed and attached readily.

The Fuselage

Square 5/32 inch longerons are used to form the body. The turtle-deck is made with a balsa wood framework. The nose-piece, including the radiator, is of balsa formed correctly to scale. For the radiator filler cap, a bicycle spoke nut is inserted at the top, giving a realistic effect.

The motor-stick bracing is arranged in such a way that none of the strain of the rubber elastic "motor" is taken by the balsa nose-piece.

The propeller is 13¼ inches in diameter. Propeller shaft is a ⅛" solid turned bearing. About 50 feet of ⅛" flat rubber is used for the motive power.

Tail Group and Controls

Ailerons on the top wing are connected with a control stick by waxed cords running through the wing and operating like real controls.

The tail group is built up in the standard fashion, of ⅛ inch square wood for the framework and 3/32 inch reed for the outline.

Elevators are connected to the control stick. A rudder bar works the rudder. The tail skid is made of ⅜ by ¼ inch white pine, streamlined. It is shock-absorbing.

Landing Gear

The landing gear is built up of ⅜ by ⅛ inch spruce, streamlined. The small chassis wing, characteristic of the Fokker planes, is located between the two landing gear Vees. Ribs in this wing are of balsa, with three beams ⅛ inch square running lengthwise through them. The leading edge is ⅛ inch square and the trailing edge 1/16-inch square.

Shock absorbers have been provided for the axle and wheels, everything being enclosed in the small wing. The wheels are 4 inches in diameter.

Covering

Covering is with bamboo paper, doped and finished in black and white.

Aeroplane Thrust Compared with the "Pull" of Other Vehicles

THE thrust necessary for propelling an aeroplane is much greater than the "traction coefficient" or "draw-bar-pull" of other vehicles of locomotion according to F. Bedell, author of "Airplane Characteristics." In an aeroplane, wing-resistance alone is, let us say, from 6 per cent. to 10 per cent. of the weight of the machine (corresponding to L/D (lift/drift) = 16.6 to 10). To this is added the parasite resistance, making the total resistance or thrust, in some common types of aeroplane, from 10 per cent. to 15 per cent. of the weight; that is R/W (resistance/weight) = 0.10 to 0.15.

The traction co-efficient of water craft is less than 1 per cent. The traction coefficient of trains on level rails is between 1 and 2 per cent., and of road vehicles on level pavement only a little more. These values, however, are increased by a grade or bad road surface so as to equal or even exceed 10 or 15 per cent.

In the matter of low thrust or traction coefficient it is seen that the aeroplane cannot compare favorably with other vehicles. It must be remembered, however, that an aeroplane travels at a much higher velocity than other vehicles and that, for the aeroplane, the air is a universal right-of-way, extending everywhere, always ready without cost of construction or of maintenance. These advantages make the aeroplane superior for its special purposes.

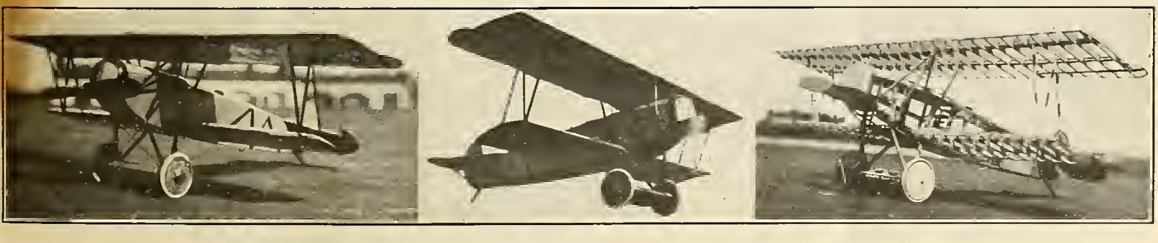
Power and Weight of Aero Engines

THE original engine of the Wright Brothers, used in the first aeroplane flight of 1903, gave only 12 horsepower with a weight of 12.7 pounds per horsepower. The development of the aeroplane engine since then, until the Liberty motor (used in 1918) is shown by the following table.

The figures, except for the first and last columns (Wright and Liberty motors) are average values of principal engines for each year:

Year	*1903*	*1910*	*1914*	*1915*	*1916*	*1917*	*1918*
Horsepower	12	54	112	133	185	243	450
Weight, lbs.	152	309	437	512	570	693	825
Lbs. per h. p.	12.7	5.7	3.9	3.8	3.1	2.8	1.8

Each year aeroplane engines have been made of greater power and less weight per horsepower. Although other types of engine may hereafter be introduced. Although other types may be looked upon as *the standard* type for aeroplanes.



A flying scale model of the Fokker D-7 Single Seater, built by Bruce Mapes from Aerial Age plans. The views show the skeleton frame work during construction, the completed model, and a snapshot of the machine in flight

A-E-R-O-N-I-T-I-S

X. Y. Z.

(This might have been dedicated to Thomas A. Edison.)

How much did Philadelphia Pa?
  Whose grass did K. C. Mo?
How many eggs could New Orleans La?
  How much does Cleveland O?

What was it made Chicago Ill?
  Twas Washington D. C.
She would Tacoma Wash., in spite
  Of a Baltimore Md.

When Hartford and New Haven Conn.
  What reuben did they soak?
Could Noah build a Little Rock Ark
  If he had no Guthrie Ok?

We call Minneapolis Minn.
  Why not Annapolis Ann?
If you can't tell the reason why
  I'll bet Topeka Kan.

But now you speak of ladies what
  A Butte Montana is.
If I could borrow Memphis' Tenn.
  I'd treat that Jackson Miss.

Would Denver Colo cop because
  Ottumwa Ia dore
And, though my Portland Me doth love,
  I threw my Portland Ore.

—*Marcus Smiley in Lippincott's.*

My Rotary

By Edward W. Weimar

(In U. S. Air Service)

The hours I spent with that old clock,
  Are as a string of oaths to me;
No matter what I did she'd always knock,
  My rotary, my rotary.

Each time I flew I said a prayer,
  To still a heart with anguish wrung;
One time I tried to zoom some trees, and there
  High up I hung, high up I hung.

On promises of what I'd earn!
  I got my dad to come across!
My ship and I are broke, and must return
    To face the Boss!
      Oh Boy!
    To face the Boss.

She: Am I the only girl you ever loved?

Breezy: Do you think this is my first shore leave?

She: O, you boys have more fun than we girls. I wish God had created me a little boy.

Breezy: He did. I'm he.—*Our Navy.*

U're Right, Professorette

A wise woman once said there are three follies of men. The first is climbing trees to shake down fruit, when, if they would wait long enough, the fruit would fall of its own weight; second is going to war to kill each other, when, if they only waited, they would die naturally; and third, that they run after women when, if they would not do so, women would run after them.—*Whiz Bang.*

"A woman came into the hospital the other day and she was so cross-eyed that ears ran down her back."

"You couldn't do anything for her, could you?"

"Yes, indeed; we treated her for bacteria."

Priceless Love

When thy little eyes are turned
  Sweetly up to mine,—
When my boyish heart has burned
  Beating close to thin,—
When the stars that grace the sky
  Twinkle in thy hair,—
When thou giv'st a gentle sigh
  Whilst I breathe a prayer,—

When I hear thee softy say
  "Come and kiss me, Mike!"—
Then I *know* I have to pay
  Anything you like.

Sweet Young Thing: Oh, mother, I simply love the sandy coves at Buzzard's Bay.

Mother: Hattie! I won't have you talking about people in such a vulgar way!

"Did either your wife or her car get injured in the accident yesterday?"

"Not very much. Just a little paint chipped off both."

"My dear Mrs. Smith, I think your daughter recites remarkably well, don't you?"

"Yes. All she needs is a short course in electrocution, sort of to finish her off, as you might say."

Doc Horn (*in chemistry*): Boettner, what does A stand for?

Boettner: Just a minute, I've got it on the end of my tongue.

Doc Horn: Well, spit it out, it's Arsenic.

At a Boston Immigration Station one blank was recently filled out as follows:

Name: Abraham Cherowsky.

Born: Yes.

Business: Rotten.

Sweet Young Thing: I can't marry you. You are penniless.

Geo. Young: That's nothing, the Czar of Russia was Nicholas.

He wrote a quatrain on her eyebrow,
  A sonnet on her throat,
And her father put a footprint
  On the tag end of his coat.

Rastus (*at the dance*): Mandy, is your program full?

Mandy: Lawdy, no, it takes mo' dan two sandwiches an' a cup of tea to fill ma program.—*The Owl.*

Now She Knows

Sapleigh: Too bad about Dapleigh's being arrested for speeding, and getting a week in jail, wasn't it?

Tapleigh: Yes, I'll bet his wife is all broken up over it.

Sapleigh: On the contrary, she says that she is glad it happened.

Tapleigh: How's that?

Sapleigh: She says that now for the first time in ten ye[illegible]s she knows where he is nights.—*Princetan Arm-band.*

Vol-steady There Now!

Tom: What's the matter? Lame leg?

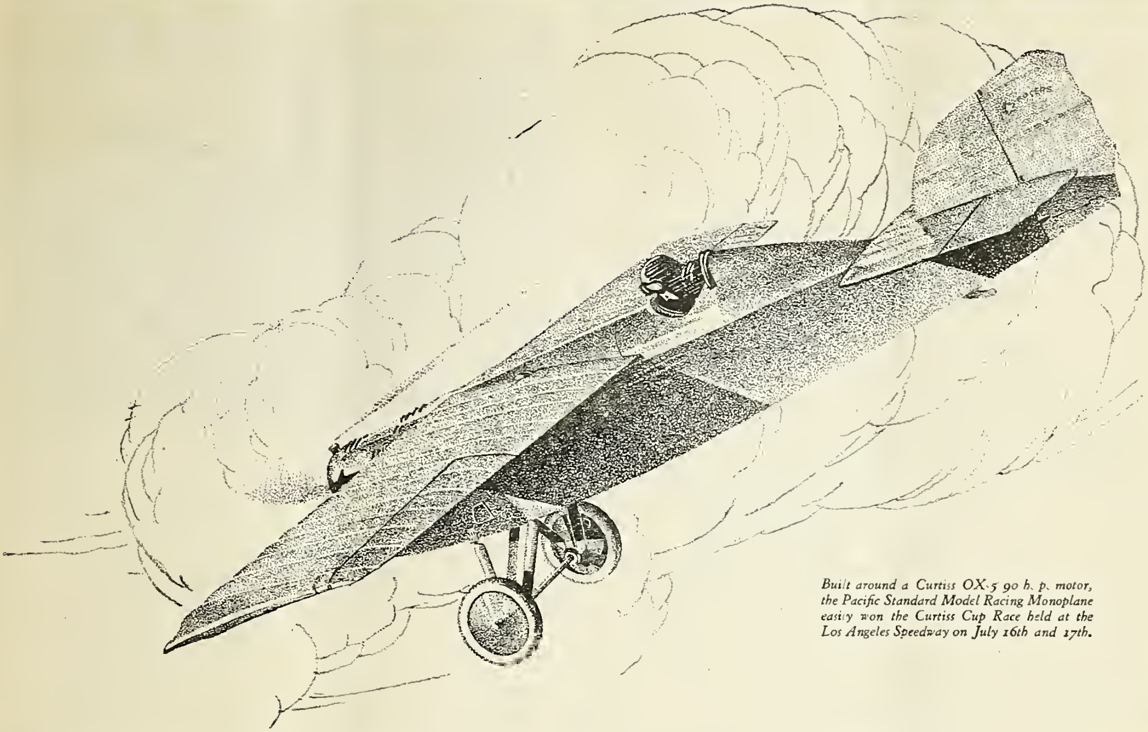
Jerry: Nope, boot-leg.—*Penn. State Nitwit.*

Why, the Eye-dea!

Nipp: The oculist says my eyes are strained and I'll have to give 'em a rest.

Tuck: 'S trouble—long studying?

Nipp: Nope, short skirts.—*Dartmouth Ash-receiver.*



Built around a Curtiss OX-5 90 h. p. motor, the Pacific Standard Model Racing Monoplane easily won the Curtiss Cup Race held at the Los Angeles Speedway on July 16th and 17th.

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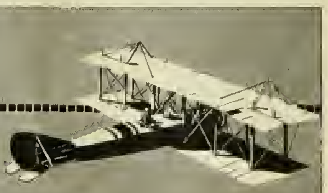

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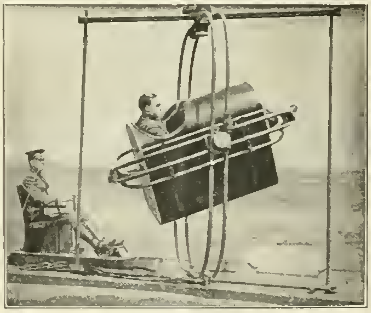

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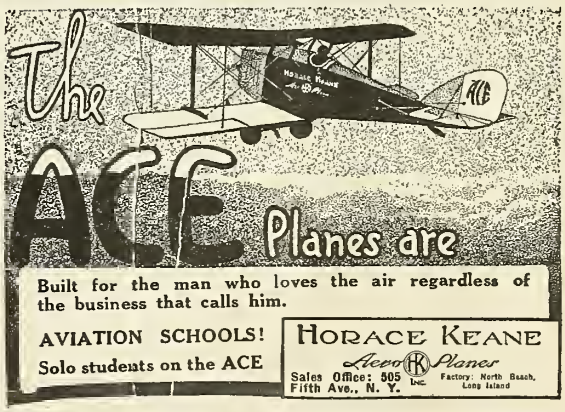

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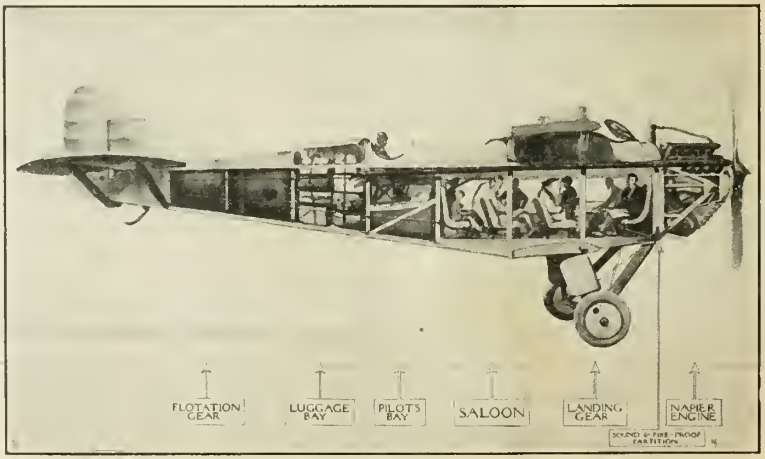

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WEEKLY

VOL. 14. No. 10 NOVEMBER 14, 1921 10 CENTS A COPY

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AERIAL AGE WEEKLY

VOL. XIV, No. 10

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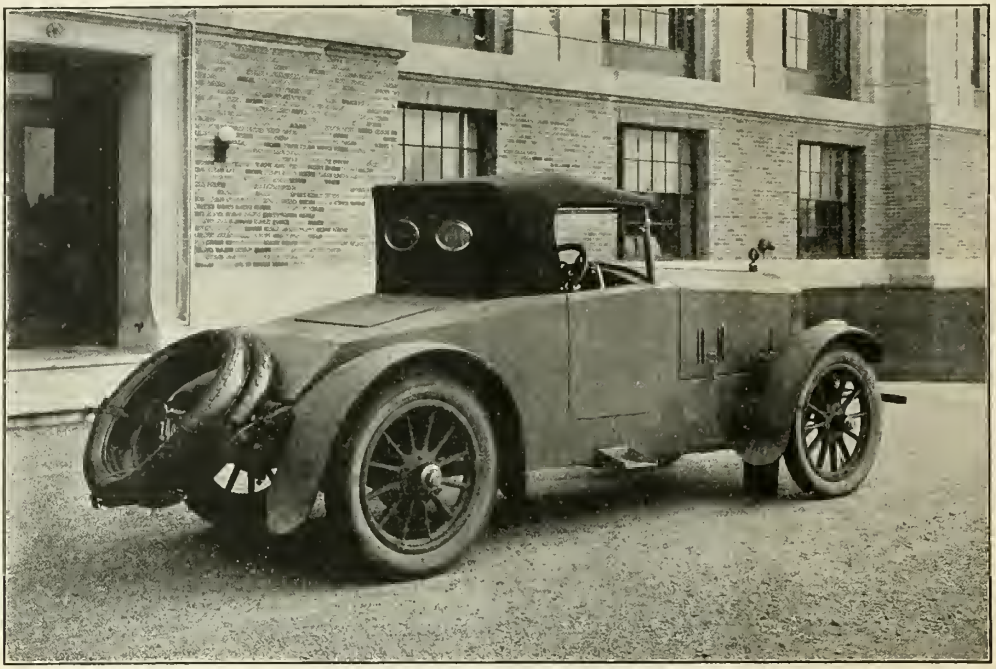

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The above photograph shows a Winton, year 1910, chassis with OX-5 motor and special body. Weight fully loaded 3,600 lbs., maximum speed 100 m.p.h. Four speed chassis, 18.3 miles per gallon of commercial gasoline by actual continuous check at 30 miles per hour in high gear without slipping clutch, acceleration standing start to 45 miles per hour in 10 seconds. In three days' city driving ran 145.2 miles on 9¼ gallons of commercial gasoline.

Send self addressed and 4-cent stamped large envelope for general data on above and Marmon installation, or one dollar for detail instructions with photographs and OX-5 booklet.

Curtiss Aeroplane & Motor Corporation

GARDEN CITY LONG ISLAND

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Flying

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The Pulitzer Trophy Race an American Achievement

BERT ACOSTA wrote international aeronautic history when he drove the Curtiss-Navy Racer to first place in the Pulitzer Trophy Race on November 3 and established a world's speed record of 176.9 miles per hour. It is a record established by a 100 per cent American aeroplane, and is a timely answer to some of our foreign critics that America is lagging in aeronautic enterprise. The Curtiss and Navy Department engineers who designed and built the winning plane and its motor deserve great credit for this achievement.

The speediest race-flying done by anyone until November 3 was in the Deutsch de la Meurthe contest held at Etampes, France, September 30 last, which was won by Lieutenant Georges Kirsch. Over a course of 186 miles, his speed was 173.1 miles an hour. He flew a Nieuport-De Lage plane.

While aviation enthusiasts at the clubs, fields and factories were eagerly reading the news that Bert—a great favorite hereabouts—had won the trophy, the more important information arrived in a telegram from Augustus Post of the Aero Club of America, who had gone to Omaha to see the race. He made known the fact that the course was longer than it had been supposed to be.

It became known that the course was accurately surveyed by the "chain" system before the race at the instigation of the Curtiss interests, which wanted to be sure of having an absolutely correct line on the flying speed of their ship should it win, which they confidently expected.

Last year's course for the Pulitzer Race—a triangle with the starting and finishing point at Mitchel Field, Mineola—was, it developed afterward, shorter than it was supposed to be. It was planned to be 132 miles in length, but an examination made afterward by the United States Geodetic Survey proved it to be actually only 116.8 miles long.

The winner, Captain C. C. Mosley, U. S. A., who drove a Verville-Packard ship, was credited in the first reports of the race with having averaged 178 miles an hour and with having broken all racing records, the best of them at that time being held by Sadi Lecointe of France, who averaged a trifle more than 169 miles an hour in winning the Gordon Bennett Trophy at Etampes in September, 1920, but a revision of figures showed that Mosley's actual time was only 156½ miles an hour.

Second place in the Pulitzer race this year was also secured by a Curtiss product, the Curtiss Cox Racer, piloted by Clarence Coombs, and the Curtiss C-12 motor installed in the Italian Ballila Scout enabled that ship to make fourth place.

Next year's Pulitzer race is to be flown at Detroit. The flying club of that city was to have held the race this year, but gave it up because it received no assistance from the army or the navy and was fearful it would not get enough entries to make the event interesting. Thereupon the lively young organization in Omaha stepped into the breach, asked for the race, got it and—as Thursday's brilliant performance proved—kept it up to its established high standard of success.

Wings of the Morning

FROM London comes the report that a 150-passenger seaplane is in course of construction, and that next year it will tune up its motors and send its 400-foot span westward at 130 miles an hour, leaving Great Britain at midday and sighting the Statue of Liberty twenty-four hours later. This is quite possible, of course. It is, in fact, inevitable. Science permits it and men wish it, and eventually it will be done. There will be larger motor units accessible to mechanicians, cabins inside the wings (as are promised for the present British machine), steel construction paralleling bridge work, and more speed than we yet dream of.

If yesterday brought news of aerial possibilities from London, it brought news of aerial performance from Omaha. The Pulitzer speed race was held there yesterday, and the Curtiss navy racer was piloted for 150 miles by Bert Acosta at a speed of 173 miles an hour. Two other machines of American make pressed upon him with approximately 166 miles per hour and 156 miles per hour, respectively, for the course. Acosta's performance was not a record; Captain Mosley last year flew at 178 miles per hour. But what yesterday's winner did and what his fellow contestants did indicate the relative permanence of high speed in flying. At the end of the war no machine was credited with a consistent performance as fast as that which took third place yesterday. Today 160 miles an hour is as easy for an aeroplane as sixty miles an hour was ten years ago. High speed, like flying the Atlantic, is inevitable and on the way toward becoming dependable and ordinary, though it is doubtful if the thrills of either will be absent even for the sophisticated next generation.—*Editorial in N. Y. Globe.*

THE NEWS OF THE WEEK

Bertaud Wins Kansas City Derby

Kansas City.—Lloyd Bertaud, after being prevented by fog from flying from New York, arrived by train in time to win the American Legion Aerial Derby over a 140-mile triangular course. His time was 60 minutes 15 2-5 seconds.

Lieut. J. D. Givens, Fort Sill, Okla., was second. His time was 66 minutes 15 1-5 seconds. Third and fourth places were won respectively by C. B. Wrightsman, Tulsa, Okla., time, 67 minutes, 17 4-5 seconds, and Lieut. Wagoner, Fort Sill, time, 67 minutes 55 1-5 seconds. Fifth place went to Major Lamphier, Fort Sill, Okla., time, 68 minutes, 12 2-5 seconds.

The prizes were' First, $3,000 and the Kansas City Rotary Club trophy cup which to become a permanent possession must be won twice in Legion events; second, $1,500; third, $750; fourth, $500; fifth, $250.

Parachute Record

Kansas City.—Sergt. Encil Chambers of Post Field, Fort Sill, Lawton, Okla., on November 1 made what officials say is the record for high parachute jumping when he leaped approximately 26,000 feet—400 feet less than five miles—from an army plane. The stunt was performed in connection with the American Legion flying meet. The descent took eighteen minutes.

Sergt. Chambers's former record was 22,002 feet. This was later broken by Lieut. Hamilton at Rantoul, Ill., last summer, when he made a jump at an altitude of 23,007 feet. Representatives of the Aero Club of America will send the sealed barograph to Washington to have it calibrated and the official altitude verified.

Both Chambers and his pilot, Wendell Brookley, were equipped with oxygen tanks and special fur-lined clothing. The ascent, according to Lieut. Brookley, took an hour and a half.

When the flyers had reached the "ceiling" Brookley gave the signal and Chambers climbed out on the fuselage. Then he dived head first into space. According to Chambers, he dropped fully 500 feet before his big silken parachute opened.

Chambers said he suffered intensely from the cold during the early minutes of the descent. He said he lighted a cigarette and smoked it during half of the downward journey.

First Airship Arrives at McCook Field

The Balloon and Airship Section of McCook Field received its first airship September 19th. It is a P-B type, non-rigid, manufactured by the Goodyear Tire and Rubber Co., of Akron, Ohio. It was ferried to McCook Field by Lieut. G. W. McEntire, who is stationed at Akron supervising the construction of a larger airship which will probably make a trial flight to McCook Field about the first of the year.

This small airship made an average speed of 44 miles per hour on this trip, averaging 12 miles to the gallon of gasoline, and used less than three quarts of oil.

The airship is to be used at McCook Field to test out various kinds of equipment, now under design and construction by the lighter-than-air Sections.

A recent review of the press reveals the fact that ships of this type are used by motion picture concerns for the taking of aerial scenes, and that two Los Angeles sportsmen flew a Pony Blimp from their home to Catalina Island for a few hours' fishing trip, and brought back their catch without leaving the ship.

Parachute Jumper Drowned

Omaha.—Harry Eibe, employed by a Chicago parachute company, was drowned in the Missouri River November 3, when he landed in the stream after making a parachute jump of 7,000 feet during the international aero congress.

Eibe had been flying with Cyle Horchem of Ransom, Kan. After his leap he evidently realized that he was going to drop into the river unless he changed his course, and he frantically manoeuvred in an attempt to save himself.

Forest Mapping in Canada

Having accomplished by flying-boats (F3's) in a few months what it would have taken years to do had the work been done on the ground, three Air Board officers arrived at Ottawa, Canada, October 25, flying their machines from Sioux Lookout, a distance of 900 miles.

The three officers, Capt. A. W. Carter, Capt. W. G. Boyd, and Capt. Clifford McEwen, have been working north of the Transcontinental Railway, mapping the forest to show the types of timber in Northern Ontario, information that will be of great value to the Canadian Government, and which they have made available in a comparatively short space of time.

The three machines they used in their daily work will be stored at Ottawa for the winter, and the men themselves will remain in winter quarters at Ottawa, completing the arrangement of their summer survey.

On the journey down from Sioux Lookout they were delayed by unfavorable weather. Landings were made at Sault Ste. Marie and Port Arthur.

They were met at Chats Falls by two aeroplanes flown by Col. Robt. Leckie and Captain J. A. Glen, of Air Board headquarters.

"Very uneventful," was the comment made by the pilots on their long journey. "We found it very cold, and encountered some snow."

The flight of the five machines over the city attracted many watchers. The planes landed in Ottawa River at Rockliffe, all in good order after the trip.

Catapult Launches Seaplane from Ship

Philadelphia. — A hydroaeroplane was launched successfully October 31 in tests at the Philadelphia Navy Yard off a catapulting device which sent the NC-9, two-seated craft, into the air at a speed of 43 miles an hour from a standing start.

The experiment proved, naval experts declared, that aircraft can be launched from battleships equipped with catapults on the turrets, and it is proposed so to equip every battleship.

The seaplane was piloted by Commander H. C. Richardson, U. S. N. Many high naval officers and scientists witnessed the tests.

The Larsen Trophy

Just as we go to press we learn that the Ansaldo S. V. A. took first place for the Larsen Trophy at Omaha on November 6, with a total of 4,671 points. The JL-6 was second with 4,640 points and the JL-6 third with 4,212 points.

The rules governing the contest were as follows:

Any craft was eligible, as the winning of the contest was based on the formula $\frac{(w-t)\,s}{g}$, in which (w) stands for total weight leaving ground, (t) stands for weight of plane minus gas, (s) stands for miles per hour actually made over the course, and (g) for amount of gas actually consumed.

The course in the Larsen contest was 250 miles in length from Omaha to Des Moines and return.

Development of Aviation Favored by the President

In a recent letter to the president of the *Boston Transcript*, President Harding expressed what he said was his "concern for the development of aeronautics." The letter said:

"I gladly avail myself of the opportunity to express my own concern for the development of aeronautics. It has become apparent that an amazing development must take place in the near future in the utilization of the air as a medium of transport and communication in both peace and war. In our country of magnificent distances it is peculiarly desirable that every encouragement should be given to the establishment of suitable landing fields wherever possible."

F. A. Donaldson Wins 90-Mile Plane Race

Omaha.—F. A. Donaldson of Spirit Lake, Ia., was first and C. S. Jones of New York second in one of a number of free-for-all ninety miles races for aeroplanes, held November 3.

Donaldson's time was 69 minutes and 4 seconds; Jones made the course in 69 minutes and 20 seconds; Harry Buff, Topeka, Kan., was third in 72 minutes and 35 seconds.

C. S. Jones of New York, who won the first ninety-mile free-for-all for planes with a speed of seventy-five miles an hour, received $300 prize money.

Book Review

The science of aeroplane performance calculations has become extensive, as aeronautics has been developed to an extremely high degree. The literature on the subject is meager, and the author of this book should find a reader and student in every engineer or designer who needs reliable data at hand. To give an idea of the scope of this handbook we quote the titles of a few chapters: Body Resistance, Wing Characteristics, Propeller Performance Curves, Machine Performance Curves, Air Performance and Water Performance. There is a valuable chapter on the typical machine.—*Aeroplane Performance Calculations.* By Harris Booth.

The AIRCRAFT TRADE REVIEW

Jones Wins Junior Derby

Charles S. Jones of Garden City, L. I., piloting a two-passenger plane, won the Legion Junior Derby at Kansas City over a triangular course of 87½ miles in 53 minutes and 53 seconds. A cash prize of $1,000 and a trophy cup presented by the Kansas City *Journal* formed the first prize. Twenty planes started in the race.

Second place was won by Paul D. Wilson of Ithaca, N. Y.; third, by J. W. Welborn of Tulsa, Okla.; and fourth by E. M. Laird of Wichita.

Air Service Contracts

GLOBES—Procurement Branch, Air Service, Temporary Building No. 6, Washington.—Bids are wanted until 2:30 P. M., November 7, circular ASA 9, for 2 terrestrial globes of the world.

CORRUGATED SHEATHING — Engineering Division, Air Service, McCook Field, Dayton, Ohio.—Bids are wanted until November 8, circular 2278, for furnishing 20 gauge corrugated metal asbestos covered sheathing for roof and ends on two cantilever hangars.

GAS GENERATING PLANT—Engineering Division, Air Service, McCook Field, Dayton, Ohio.—Bids are wanted until November 15, circular 2279, for 1 gas generating plant.

DRILL PRESS—Procurement Purchase Branch, Air Service, Temporary Building No. 6, Washington.—Bids are wanted until 3 P. M., November 16, circular AS 6, for one 24-inch upright drill press.

Commences Instruction at 42

"It's never too late to learn."

That is the motto of Alexander Schmidt, 42 years old, who is officially too old to become a unit of Uncle Sam's air service.

But Alexander Schmidt, who has been in the service of Uncle Sam for twenty-two years, being stationed most recently at Luke Field, Forts Island, Pearl Harbor, Honolulu, with the Sixth observation squadron, has an unofficial view of the question. Having spent four years in the air service, he says he is going to learn how to paddle his own air canoe or know the reason why.

After eight years in Honolulu, Schmidt has come to San Francisco on a three-months' furlough to gain instruction in flying. He came here because he is beyond the age limit when men may obtain army instruction.

The Varney Aviation Company at San Carlos has undertaken to teach Schmidt the art of flying.

An Interesting French Machine

The De Monge 5a machine which Capt. the Comte de Romanet was to have flown in the Aerial Derby is a machine which possesses a number of interesting features.

It has already, in the account of the entries for that race (The Aeroplane, July 13th) been described as a monoplane fitted with bracing struts running from the top of the under-carriage to about two-thirds of the half span out from the body, and this description is accurate. It is, however, also a biplane, and it was as a biplane that it would have appeared in the Derby had it not suffered a certain amount of damage caused by the collapse of one wheel when landing.

As originally designed the machine was a monoplane, and its general appearance conforms very closely indeed to Mr. Bridgman's sketch published in the aforementioned issue.

The conversion to a biplane is effected by attaching, to the bottom of the fuselage, a pair of lower wings, of small chord and of slightly less span than the upper wings, and supporting these lower wings by one pair of Vee struts—running from the front and rear spars of the upper wing—on each side.

It is said that with the added surface the speed of the machine was appreciably increased.

A curious feature is the shape of the fuselage. This is of circular section, and is entirely normal for about the front half of its length. Behind the upper wing the diameter is reduced very rapidly and in a hollow curve running into a nearly parallel tube of small diameter.

The machine is fitted with a La Tombe compressed-air self-starter, and carries a single Lamblin radiator over the center of the upper wing. Petrol tanks are apparently attached to the under surface of the top wing, at the junction of the bracing struts with that wing.

The main dimensions, etc, are as follows:—

Specifications of De Monge 5A

Span 8 metres. Length 7 metres.

Chord, top plane, 2.6 metres (center).

Chord, top plane, 1.0 metre (tips).

Chord, bottom plane, 1.0 metre.

Total wing area as monoplane, 15 sq. metres.

Total wing area as biplane, 20 sq. metres.

Engine, 300-h.p. Hispano-Suiza. Weight (full load), 900 kg.

Estimated speed (ground level) 320 km.p.h.—(*Aeroplane.*)

Air Torpedo Tested

Washington.—A successful mechanically controlled flying torpedo, destined to revolutionize land and sea warfare, has been developed for the United States Army and Navy air services. In a secret test, made two weeks ago, this remarkable aircraft, said to be the most important aerial weapon ever constructed, flew over New York City and two Eastern states. According to aerial experts here, the flying torpedo, had it been loaded, could easily have wrought great destruction to lower Manhattan.

The experiments have been carried on for several months on Chesapeake Bay, in New Jersey and Ohio in strictest secrecy, not more than 100 persons in the entire country having any knowledge of it. The machine already has made upward of a hundred flights, approximating 5,000 miles.

Its existence undoubtedly will exert a profound influence upon the Conference on the Limitation of Armament, which opens here this week, because development of the craft, according to the experts, means that coastal fortifications are rendered obsolete.

Attacking in large numbers, machines of this type would be able to annihilate cities with incendiary explosives and poison gases without the loss of one life to the attacking forces, the experts declare. In actual warfare the flying torpedoes will be guided through the air to their targets without a person on board.

During the flight over New York City the experimental flying torpedo made an unexpected landing near a small town in eastern Pennsylvania. This incident attracted little attention at the time.

Upon receiving a report of the landing of the mysterious aircraft, however, the New York *Tribune* began an investigation, and now is in a position to outline the characteristics of this remarkable machine and its possibilities. The details of construction and control are still shrouded in mystery.

The test flight on that occasion commenced from a landing ground near New York. After the engine was started the machine ran a short distance across the field, and then took the air successfully and climbed to the predetermined altitude. It then set a course due west, straight into a stiff head wind.

The most remarkable feature of the new craft is the development which causes it to take off from the starting field. The secret apparatus controlling the elevators, which govern the ascent and descent of an aeroplane, is absolutely successful, according to the experts who have watched the experiments. For straight flying across country the machine is equipped with apparatus which gives it inherent stability, causing it to right itself under all conditions.

From official sources it is learned that the flying torpedo is designed for offensive action against enemy coasts, cities or fleets. In naval warfare it will be further controlled by radio, and at no time will machines of this type fly more than twenty feet above the surface of the sea during naval engagements. It can be flown at any altitude while being used in attack against cities or coast defenses. The flying torpedoes will be filled with incendiary explosives and poison gases.

The object of flying low in naval battles is based on two important factors. First, the present indicated defense against attacking aeroplanes—besides other aircraft—is detonation set up by a barrage of anti-aircraft guns. The theory of this defense is that, while no attempt is made to obtain a direct hit, a terrific air disturbance will be set up by the exploding shells, making it practically impossible for the attacking machines to approach their objectives. This, of course, will be obviated by low flying.

The other factor is based upon the fact that when a machine is flying very low there is a back pressure of air from the ground—or sea—which tends to keep the machine in the position in which it is flying. This, with the radio control, will make the flying torpedoes almost invincible, as only a direct hit will put them out of action.

In this manner hundreds of the machines can be set to fly straight toward a fleet, and then circle around until they strike one of the battleships. Or they may be directed by an attacking fleet against enemy cities from a distance of 200 miles or more.

THE PULITZER RACE

Omaha.—Bert Acosta, veteran flyer, won the Pulitzer trophy race November 3, covering the 153½-mile course in 52 minutes, 9 1-5 seconds. This is at the rate of 176-9 miles an hour.

Weather conditions were perfect. The record for the race, 178 miles an hour, made last year, is held by Capt. C. Corliss C. Mosley of the Army Air Service, now on duty in Washington.

Lieut. Col. H. E. Hartney, Executive Secretary of the Aero Club of America, fell 1,500 feet with his plane near Loveland, Iowa, and suffered a fracture of the hip and serious internal injuries but will recover, the Omaha Hospital surgeons report. His machine was destroyed by fire originating in the cigarette of one of a hundred souvenir seekers.

Acosta's victory brings the Pulitzer trophy race to New York next year unless Acosta should have made a technical registration of his entry as from a flying club in some other city. There is no evidence that he did so. He retains the trophy cup for a year or until the annual race is won by another contestant. A cash prize of $3,000 goes to Acosta, one of the best known and most skillful aviators in the United States, a professional flyer and an expert tester of flying machines for several manufacturers, among them the Curtiss Company. He drove a Curtiss navy racer, with a 400 horsepower CD-12 motor in the race to-day.

Clarence Coombs of Houston, Tex., was second in a plane called the Cactus Kitten, his time being 54 minutes 7 3-5 seconds. Lieut. John A. Macready, in a Thomas-Morse, attached to the Army Air Service at Dayton, O., holder of the world's altitude record, was third in 57 minutes 27 3-5 seconds. Lloyd W. Bertaud of New York was fourth in a Balilla Scout. James Curran of Chicago was forced to descend and abandon the race.

The course was triangular, with Omaha and Carson, Neb., and Loveland, Iowa, across the Missouri River, for its corners, a lap of thirty miles, around which the flyers raced five times.

The day was all any speed pilot could ask. The sun shone, the atmosphere was clear with splendid visibility and a ground temperature of 48 degrees. A mild breeze too light to affect the starting, blew throughout the afternoon.

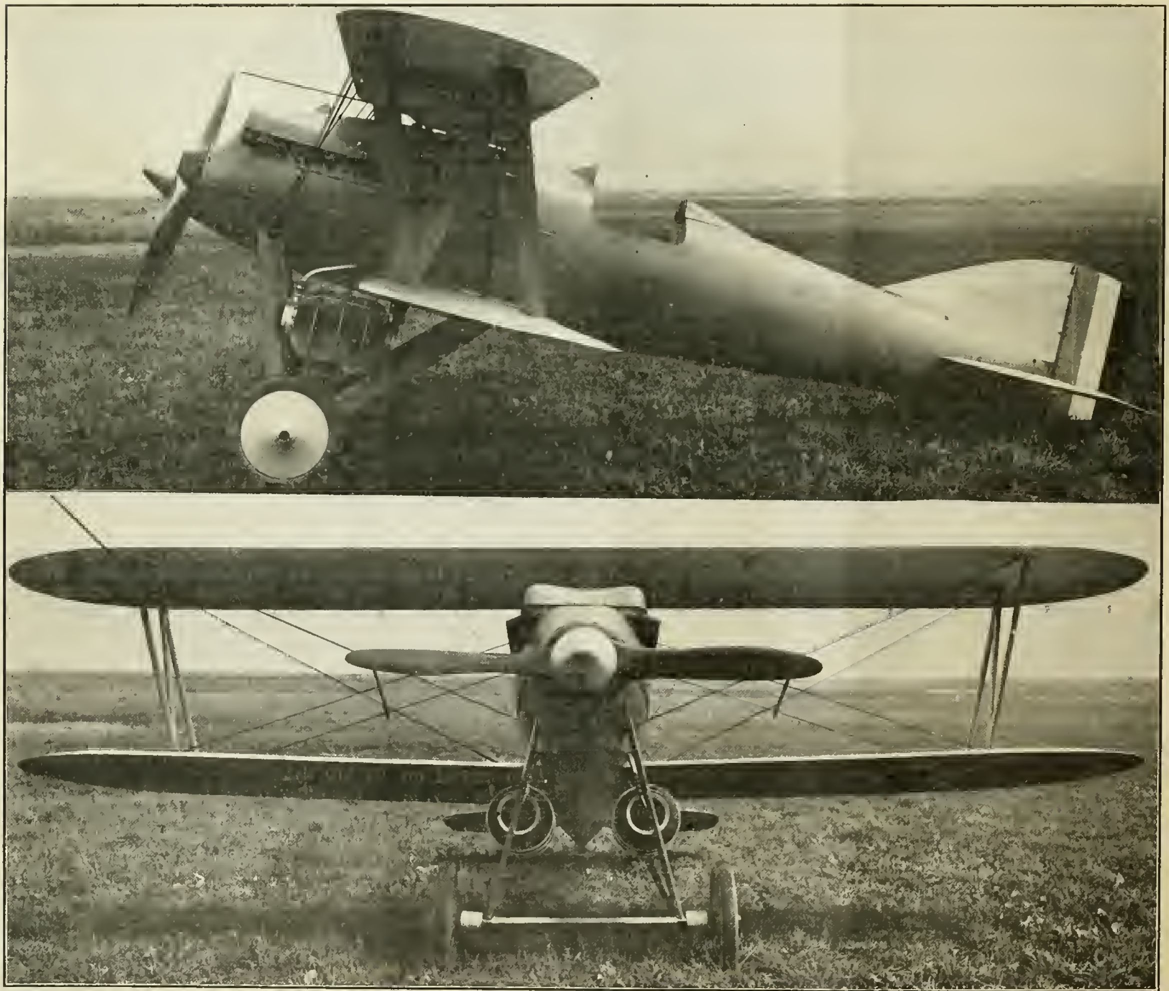
The Pulitzer Trophy race was the centre of interest and the opening event of the three-days session of the International Aero Congress here. Thousands of spectators flocked to the flying field.

The start of the race was delayed by engine trouble in Colonel Hartney's machine. Eventually the signals were given and the racers got away without Hartney, who was allowed time in which to repair his engine.

Bert Acosta in the toss-up won the privilege of starting first. He crossed the starting line at a terrific speed, estimated at more than 250 miles an hour, and was out of sight behind the hills in a moment.

Lloyd W. Bertaud of New York, in an A-1 Balilla with 400 horsepower motor, followed Acosta three minutes later. Bertaud flew high, whereas Acosta barely skimmed the line of trees on the hill.

The third man out was Clarance Coombs, driving the Curtiss Cactus Kitten, from Houston, Tex. It was painted bright red



Two views of the Curtiss Navy Racer, which Bert Acosta piloted to first place in the Pulitzer Race, establishing a world's record. It is equipped with a Curtiss C.D.12 400 H.P. Motor

and was the favorite with the crowd. When Coombs crossed the line getting the very limit of speed from his machine he was cheered by the spectators.

Before Coombs had got out of sight Acosta was back, having covered the first thirty-mile lap of the race in nine minutes forty seconds. He was off again on the second lap before the fourth and fifth men took the air.

Colonel Hartney was scheduled to follow Coombs, but because of trouble with his gasoline pump, gave place to James Curran of Chicago, in a S.V.A. Model 9, He and Capt. J. A. Macready of New York, flying a MB-6 300 horsepower plane, were sent into the race.

For the next forty-five minutes the air was full of racing aeroplanes. At times as many as three were coming down the course at the same time.

On the third lap Curran was forced down and made a perfect landing on the field. Engine trouble had developed and he was out of the race.

From the start the race was between Acosta and Coombs in the Cactus Kitten. The Kitten gained on straightaway, while Acosta made his gains on the turns.

The evenness of the race is shown by the time of the different machines; less than nine minutes separated the winner and the slowest plane in the race.

While the other machines were circling the course Colonel Hartney was endeavoring to get his plane in condition to take the air. When the last of the other entrants had completed the 150 miles and were on the ground, Hartney and his mechanicians were still working. Finally the committee in charge gave Hartney twenty minutes in which to start.

With two minutes to spare, Hartney crossed the line. He should have made the first lap in approximately ten minutes. When fifteen minutes had passed and his machine had not returned, the interest became intense.

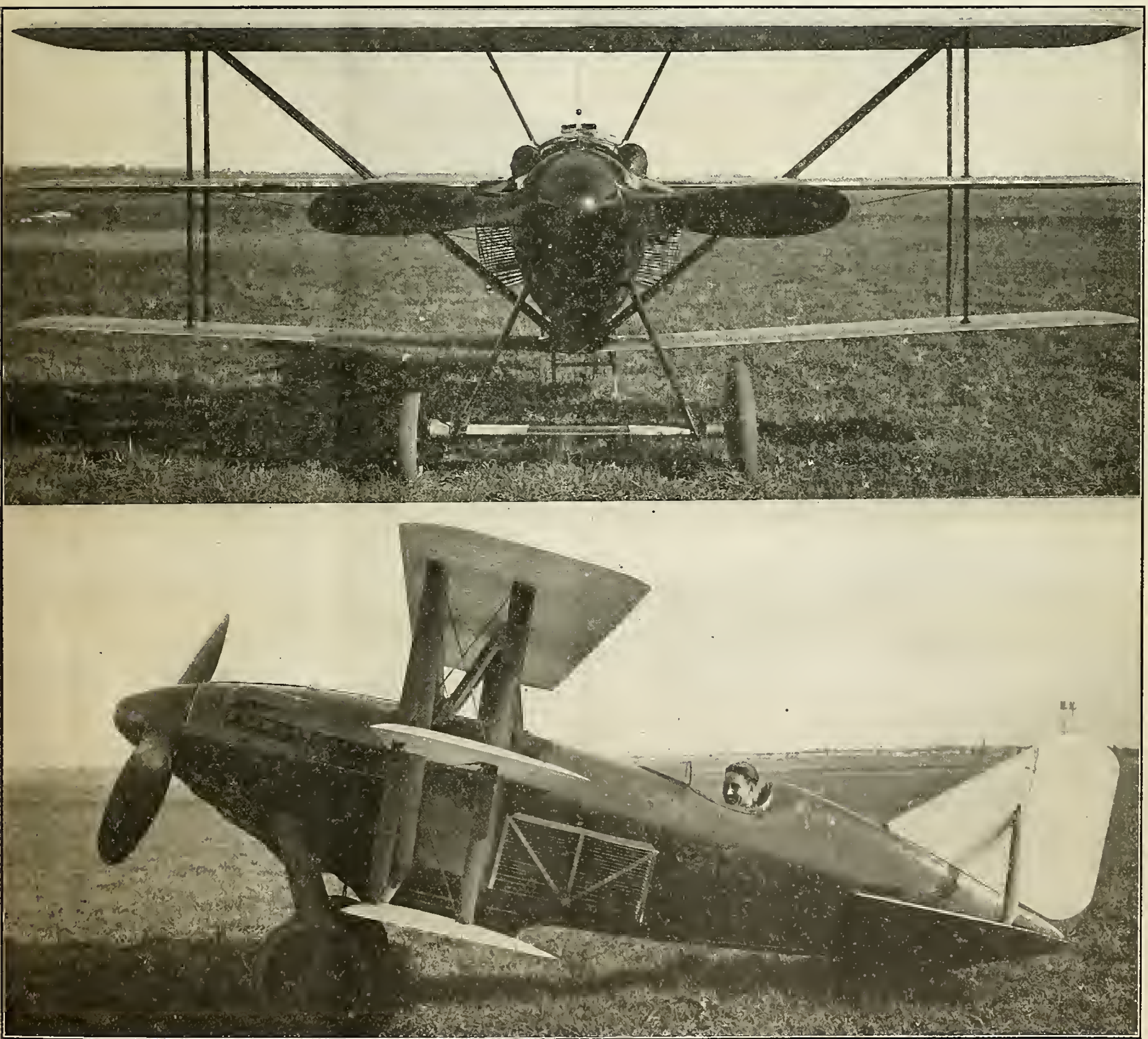
"Where is Hartney?" was asked on all sides.

When Hartney had been overdue 20 minutes, and aeroplanes were being made ready to go in search of him, a farmer on the course telephoned in that an aeroplane had come to the ground near his home and that the pilot was injured. Assistance from the nearest relief station was rushed to Hartney, who was carried to a farmhouse and treated by a physician.

Souvenir hunters from a nearby town rushed to the scene and some one dropped a match into the wrecked aeroplane. The machine was completely burned.

Hartney explained his gasoline pump had failed to function and that when he attempted to change to his emergency supply, the switch stuck. He nose-dived to the ground.

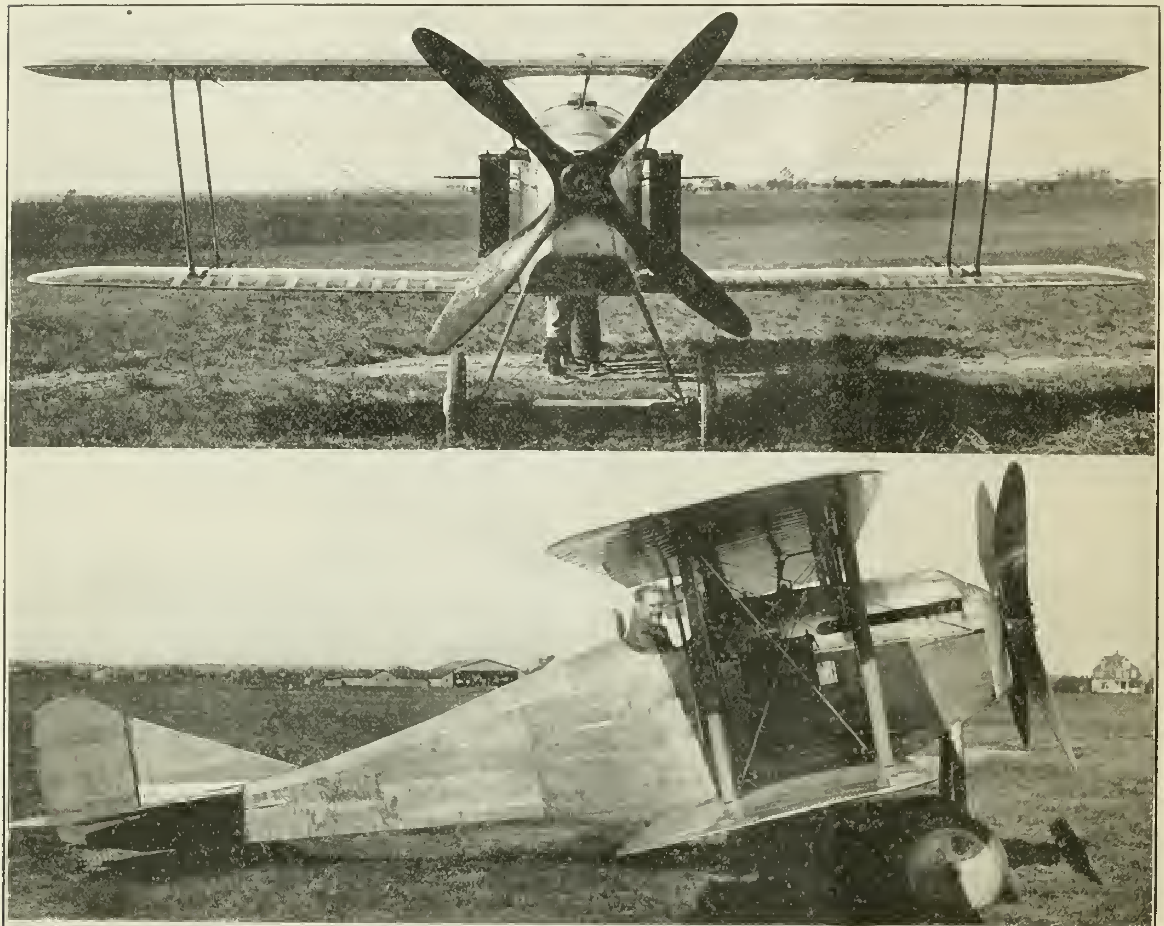
Lieut. Col. Hartney, a lawyer, went from



Two views of the Curtiss-Cox Racer, which Clarence Coomhs piloted to second place in the Pultizer Race. It is powered with a Curtiss C-12 400 H.P. motor

the United States to Saskatchewan before the World War and enlisted with the Canadian forces in 1915. He served in the trenches with the British, was assigned to the Royal Air Service and fought in the air in Italy and France. When his native land entered that struggle he joined the United States air forces, was promoted to be major and later was Lieutenant Colonel and in command of the first American pursuit group. He is an ace, and has a record of destroying six enemy planes.

In last year's Pulitzer Trophy race, flown at Mineola without an accident of any kind, Colonel Hartney finished second.



Three views of the Ballila Scout plane which Lloyd Bertaud piloted to Fourth Place in the Pulitzer Race. It is equipped with a Curtiss C.12 motor

LANGLEY FIELD WIND TUNNEL APPARATUS

By **D. L. BACON**
Langley Memorial Aeronautical Laboratory

THE difficulties experienced in properly holding thin tipped or tapered aerofoils while testing on an N.P.L. type aerodynamic balance even at low air speeds, and the impossibility of holding even solid metal models, at the high speeds attainable with the National Advisory Committee's wind tunnel, necessitated the design of a balance which would hold model aerofoils of any thickness and at speeds up to 150 m.p.h.

In addition to mechanical strength and rigidity it was highly desirable that the balance readings should require a minimum amount of correction and mathematical manipulation in order to obtain the lift and drag coefficients and the center of pressure.

The general scheme of the balance herein described is similar to that which has for some years been in use at the University of Göttingen, the main difference lying in the addition of a device for reading the center of pressure directly, without the necessity of any calculation whatsoever.

A schematic diagram of the balance is shown in Fig. 1. The wing A is hung upside down from the direct reading balance B by means of four wires attached to a frame which will be described later. These four wires hang perpendicular to the air stream and thus carry the lift force on the model. In like manner wires m and n lying in a horizontal plane through the axis of the tunnel carry the drag force to the common point O where they connect with the vertical wire *d* and the two wires *x* and *y* lying in a transverse plane at 45° to the vertical and fastened at their lower ends to the tunnel floor. It is obvious from a resolution of the forces through *o* that the vertical force in *d* is equal to the component of *M* and *N* along the axis of the tunnel and is measured by a simple weighing beam fastened to a bench directly above the center of the tunnel.

The counterweight W is used for two purposes, viz., to prevent the wing from rising at angles of negative lift, and to maintain an initial tension in the complete wire system. It is normally carried slightly downstream by a pulley in order to produce initial drag but is allowed to hang directly downward when the center of pressure is being measured.

The details of the mechanism used for adjusting the angle of attack and for locating the center of pressure are shown in Fig. 2. The four lift wires hang from the aluminum frame ABCD which is hinged at C and D to the horizontal frame EFGH relative to which it may be angularly adjusted by a geared sector and a pinion to which is fastened an index plate at E, fitted with a spring dowel which automatically locks the frame ABCD at the exact angle desired. As the lift wires, the wing chord and this frame form a vertical parallelogram it will be seen that the chord line will always remain parallel to the frame ABCD and that the angle between AD and EH may be taken as the angle of attack. A slight error is introduced by the uneven stretching of the lift wires when loaded, but this is usually negligible.

The method used to obtain a direct reading of the center of pressure is best explained by reference to Fig. 3. The center of pressure, defined as the intersection of the resultant *R* and the wing chord is shown at P and the resolved forces by L and D respectively. The line of action of L intersects

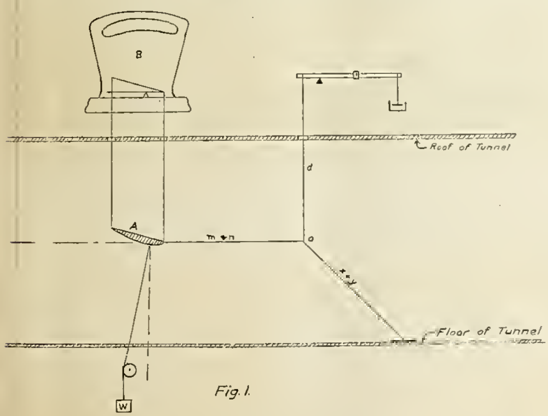


Fig. 1.

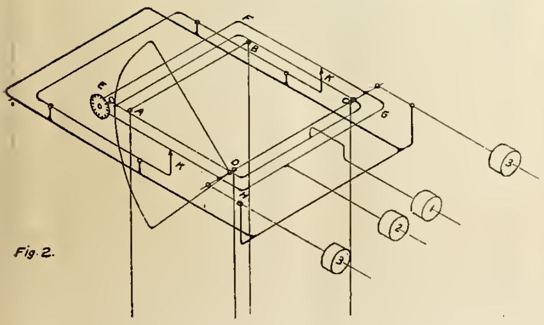


Fig. 2.

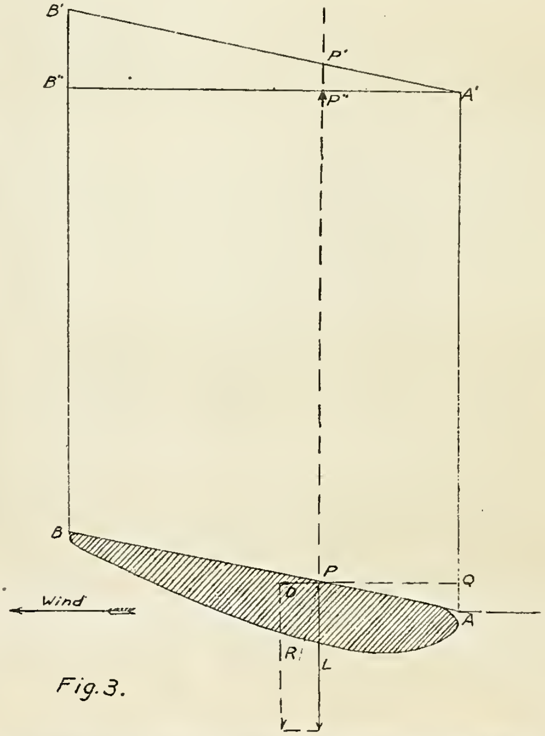


Fig. 3.

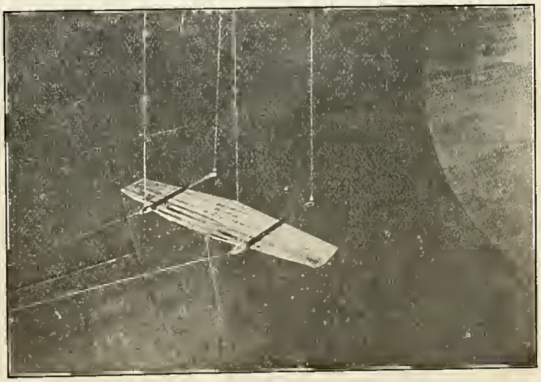


Fig. 4

an imaginary wing chord at P^1 and divides it in the same ratio as the actual wing chord. By finding a point as P^{11} where the frame EFGH may be supported in equilibrium by a pair of sliding knife edges the center of pressure of the wing may be read directly from a suitable scale. The drag force D acting at a distance QA from the line of action of the drag wire introduces an error in this reading of

$$\frac{D}{L} \tan a \times \frac{AP}{AB}$$

which for a normal wing reaches a maximum value of about 1% of the chord at an angle of attack of 16° and which may therefore be neglected In order to eliminate the effect of the centers of gravity of the various masses a series of counterweights (Fig. 2) has been provided which bring these centers of gravity to lie on the axis CD, No. 1 being connected with frame AB'CD and No. 2 with EFGH. Beams No. 3-3 rest on knife edges bearing on the balance platform and support the entire moving mass in a state of neutral equilibrium when no air is passing through the tunnel. The knife edges K K slide on ways and while testing can be lifted by a cam against EFGH at any position along the imaginary chord for a trial balance. The knife edges are then moved forward or backward until equilibrium is reached. The center of pressure thus obtained is read directly in per cent of the chord with an accuracy of about 1 per cent except in the neighborhood of zero lift, when it becomes indeterminate.

The model wing is fastened by countersunk nuts to studs projecting from two steel skids attached to the wire system, as shown in Fig. 4. The zero angle is set by means of a spirit-level, and the turn-buckles in the wires.

This balance has given satisfaction in service, holding all types of wings at speeds up to 120 miles per hour, and proving convenient and labor saving during routine tests. The large drag correction for the wires prevents great accuracy of drag measurements with small models but the relative magnitude of this correction decreases as the size of the model increases.

A COMPARISON OF SPAR WEIGHTS OF TAPERED AND NON-TAPERED MONOPLANE WINGS

By R. E. ROBILLARD

Aeronautical Structural Engineer, McCook Field

WHILE the straight wing is better both for production and for ease of maintenance, the tapered wings (either tapered in elevation, plan, or both) has been frequently used for supposedly superior aerodydamic qualities and savings in structural weight.

Both claims have been challenged, and in an effort to gather some data on the question from the point of view of weight, this investigation has been carried out. While this report does not consider the aerodynamic efficiencies of the various forms, the data on weights will be of some use in comparing the various shapes in conjunction with what data there is on the aerodynamic qualities of the tapered wings.

From the results of this study it may be said that for normal aspect ratios, a thick straight wing is lighter or no heavier than the tapered wing. Admitted that the straight wing is as heavy or slightly heavier than the tapered wing, the advantages in production and maintenance easily overbalance any small increase in weight for most types of aeroplanes.

An increase in wing weight of 10 or 12 per cent has but a small effect upon the performance of an aeroplane, so that any advantage that the tapered wing could have over the straight wing must come through increased aerodynamic efficiency. Unless this gain is large, there can be no justification for the tapered wing except for very fast aeroplanes.

It should be noted that the per cent differences in weight were computed for the spars alone; the per cent differences for the total wing structure would be less, probably halved.

The original designs were based upon the USA. 27-C section, while the straight wings were based upon the Göttingen No. 387 section. Only the cantilever portions were considered.

The first study was made for the wings for the TW-5. This aeroplane was designed for two sets of wings tapered in elevation only. Below is given the data for the two wings of this aeroplane.

Data on the TW-5

	Primary Training	Advanced Training
Aerofoil...........	U.S.A. 27-C (constant chord)	U.S.A. 27-C (constant chord)
Span...............	37′ 0″	28′ 5″
Cantilever.........	13′ 6″	9′ 2½″
Chord..............	90″	90″
Aspect ratio........	4.94	3.80
Gross weight	1620 lbs.	1550 lbs
Net weight (without wings)..........	1300 lbs.	1300 lbs.

The straight wings were identical to the tapered wings with the exception of the change in aerofoil section. The design for both the tapered and the straight wings was carried out as follows:

1. The tension flanges of the spars were assumed to be the same weight as the compression flanges.
2. The weight of the web members was estimated by designing a member for the average shear and multiplying its weight by the number of web members.

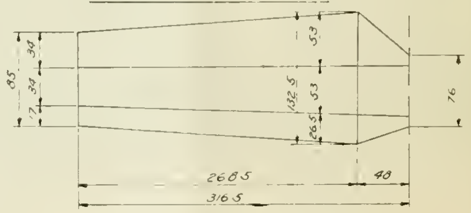
The results showed the straight wings to be slightly heavier than the tapered wings for the primary training aeroplane, but the reverse was true for the advanced training aeroplane in which the aspect ratio was lower. Table I gives the weights of the spar members, the total weights and the per cent differences for the tapered and the straight wings.

Table I.

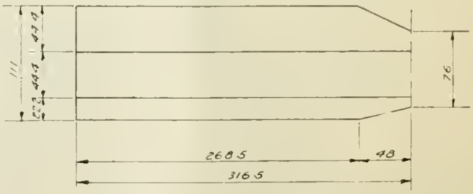
TW-5

Design	Primary		Advanced	
Front:				
Section......	U.S.A. 27-C	Göttingen No. 387	U.S.A. 27-C	Göttingen No. 387
Flanges......	8.20 lbs.	8.04 lbs.	3.76 lbs.	3.64 lbs.
Web.........	3.78	3.44	2.54	2.37
Total........	11.98	11.44	6.30	6.01
Rear:				
Flanges......	7.68	9.00	3.42	2.96
Web.......	2.68	3.02	1.66	1.92
Total.......	10.36	12.02	5.08	4.88
Both spars.....	22.34	23.46	11.38	10.89
% of total.....	100%	105%	100%	96%

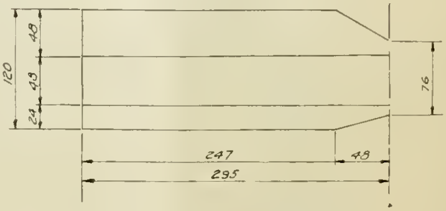
WING FORMS FOR C.O-3



ORIGINAL DESIGN WITH TAPERED WINGS



FIRST DESIGN WITH STRAIGHT WING



SECOND DESIGN WITH STRAIGHT WING

The second design studied was the C.O. 3, the wings of which had been designed for the USA. 27-C section, tapered both in plan and elevation. The weight estimate of these spars was made from the data given in the report on "Structural Design of Wings for C.O. 3" Serial No. 1634.

For the straight wings, two spar designs were carried out, the first using the same span and the mean chord, and a second, using a shorter span and a chord length mid-way between the mean chord and the chord at the root of the tapered wings.

Below is given the data on the wings for the C.O. 3.

	Original Design	1st Design Straight Wing	2nd Design Straight Wing
Aerofoil	U.S.A. 27-C	Gottingen No. 387	Gottingen No. 387
Span	633	633	590
Cantilever	268.5	268.5	247
Chord	132.5 (root) 85.0 (tip)	111	120
Aspect ratio	6.14	5.7	4.9
Gross weight	4900		
Net weight	4305		

The design was caried out in full detail for the front spar in each case. No design was made for the rear spar as the original design had used the same sizes for both spars.

For the first design, using the mean chord, the straight wing was heavier than the tapered wing. For the second design the straight wing was lighter than the tapered wing.

Table II is a summary of the weights of the spars for the three designs considered.

Table II.

Front Spar—C.O. 3

	Original Design	1st Design	2nd Design
	Wing.....316.5	Wing.....316.5	Wing.......295
	Chord...{ 85 132.5	Chord....111	Chord....120
Upper Chord	22.2 lbs.	25.4 lbs.	17.3 lbs.
Lower Chord	15.4 lbs.	15.2 lbs.	10.4 lbs.
Web	9.2 lbs.	12.3 lbs.	10.4 lbs.
Total	46.8 lbs.	52.9 lbs.	39.5 lbs.
Web % of total	19.7%	23.1%	26.3%
Total weight % of original	100%	113%	84.2%

CARBURETION AS A PRIME FACTOR IN PRODUCING POWER

By G. M. BROWN

WHILE much has been said and written and many warnings given during the past few years, it is really doubtful if the seriousness of the fuel problem in relation to the internal combustion engine is fully realized.

While the growth of the land motor, or automobile, during the past decade has been truly phenomenal, should, during the coming decade the air motor make even a fractional growth, the combined requirements for the necessary fuel would be tremendous.

Aside from certain local conditions, the natural elements of power, the windmill and the water-wheel, are not worthy of serious consideration. The real commercial source of power lies in the evaporation of liquids.

Most prominent in these, and the only ones worthy of consideration, are water, petroleum, and ammonia.

In the mechanical and conservation use of these fluids there is a great difference. There is as much water today on the face of the globe as there ever was, in spite of the fact that light and power have been produced by its utilization.

In the large use of liquid ammonia for refrigeration, by far the major portion is reclaimed by compression after evaporation.

But with so-called gasoline once used in the motor, it is gone, never to return again, at least in any usable form.

Another difference lies in the fact that while the vapor of water and ammonia have their value strictly within themselves, gasoline owes its value to its complete mixture with air, and herein lies the true meaning of the word carburetion.

Unfortunately, this word has no real meaning today. It simply signifies a method of getting fuel, whether liquid or vapor, into a cylinder. It does not stand for an efficient mixture for correct power purposes. In other words, it does not mean evaporation and mixing.

The so-called carburetor of today is purely acknowledged as a metering device, adjustable to the amount of effective evaporation that may take place in the manifold and cylinder before combustion. The less complete the atomization, and the wetter the mixture, the harder is vaporization, and the higher the temperature required. Thus the simple natural idea of evaporation is complicated with inefficient methods which may force evaporation but do not complete mixing, sacrificing not only simplicity but volumetric efficiency.

From a chemical standpoint there is no doubt as to the consistency of an effective power charge. This is a known factor.

All fuel used beyond this amount is waste, and at the same time costly. Assuming that the cylinder temperature may finally evaporate a certain amount of liquid fuel, it seems highly improbable that within the time limit it can form a homogeneous mixture with the air already drawn in and in the function of compression.

Therefore, why not assume that the real method of efficient engine service lies in correct carburetion.

In this idea there are only two necessary factors to consider, evaporation and mixing.

A study of atmospheric laws as expounded by some of the greatest scientists on the subject will point the way.

When an idea or a device has outlived its usefulness owing to conditions, it is time to change the idea or device, not waste time on antidotes.

The present form of carburetion is a relic of the past. Based on certain natural laws, it can be brought down to requirements. Never efficient in practice, its basic principle has not been greatly changed in a dozen or more years.

As one engineer said to me in a recent letter referring to the carburetor, the reason it ever vaporized was the fault of the fuel rather than the efficiency of the instrument, and he was a carburetor engineer at that.

There are only two things to accomplish: extreme divisibility, condition for complete mixing.

While heat may help the divisibility, there are simpler means, and heat will not make an equality of mixture in chemical contents per cubic inch of cylinder charge.

A whole lot of time has been wasted in trying to correct an existing evil instead of using a little mental energy to abolish the primary evil.

In this regard it might be well to remember a few plain facts.

Evaporation takes place at all temperatures. Heat simply attempts to accomplish the results where insufficient divisibility fails, therefore it is not the superior functioning of heat as temperature, but poor preparation of the fuel toward evaporation, that leads to improper vaporizing. There are enough heat units in the necessary volume of air entering a cylinder to vaporize the amount of liquid fuel chemically required to produce a perfect mixture.

Rapid diffusion by proper mixing not only aids vaporizing, but ensures an equality of mixture both in the manifold and the various cylinders.

THE MANEUVERS OF GETTING OFF AND LANDING*

By SQUADRON LEADER R. M. HILL, M.C., A.F.C.

PART I.—INTRODUCTION

1. General Remarks

THE maneuvers of getting off and landing are to me the beginning and the end of flight; they separate the sheep from the goats; the aristocrat of the flying world uses them for the display of his genius, leaving his would-be imitators to find what consolation they can in the amusement with which they innocently provide the onlookers.

In commercial flying the maneuvers of getting off and landing are still the most obvious calls on the pilot's skill; and who shall deny the splendid response? But a determination to ease the pilot's task is not thereby for an instant to be excused. This, one of the most urgent problems before applied design today, lies in the conflicting requirements of ease and safety in getting off and landing and those of economy and usefulness in full flight. To assist in the statement of this problem is the object of my Paper. These are the maneuvers perhaps about which most has been said, and, from the pilot's point of view, least written. Since first a heavier-than-air machine left the ground, they have never failed as a topic of conversation throughout the whole flying community; and this has tempted me to analyze them on the basis of my own experience and that of the many pilots I have known.

Theoretical analyses of these maneuvers, while endowing the assumed pilot with human characteristics, have of necessity to envelope in a hypothetical average the diverse individual variations. Yet, in practical flying, pfoximity to the ground in the neighborhood of stalling point throws into stronger relief than at any other time human variations in handling. There are many classes of pilot in whose flying various degrees of intelligence and instinct are blended; and each class has its own way of meeting the difficulties and ensuring what it considers to be the maximum of safety. So it is difficult to make a sweeping generalization. At the same time, almost independently of the quickness of a get off, or the slowness of a landing, it is possible to recognize in it what is termed good or bad style, something which can or cannot be identified with cleanness of handling, reliability and a sense of mastery.

The maneuvers of getting off and landing may be divided into two classes; firstly those under normal and satisfactory conditions, with reasonably good ground and sufficient space for the pilot to get off and land without taking into account any limitations save those of his aeroplane; and secondly what are termed forced maneuvers, maneuvers in which the pilot is limited in some way; for example, getting off in a confined space, over unnaturally high obstacles or on bad ground, or, after engine failure, judging a landing in an unknown field.

A forced landing with an aeroplane on which a pilot is experienced is frequently taken as the ultimate test of his powers of foresight, judgment and flying capacity; if, then, he is not quite at home on the particular type he is flying, his difficulties in forced maneuvers will be increased tenfold. Yet the pilot has even now, due to the imperfection of the aero engine, to face the possibility of a forced maneuver on types with which he is unfamiliar before he has had the chance to become experienced on them; and so such maneuvers are worth all the study and preparation beforehand that he can possibly give.

2. The Nature of "Getting Off" and "Landing."

The maneuver of getting off will be taken to commence with the opening of the throttle when the aeroplane is at rest, and to conclude with the condition of steady climb free from the embarrassing proximity of the ground; that of landing to extend from the moment that the pilot is influenced by the necessity of approaching a definitely limited landing space, to the time when the aeroplane is again at rest on the ground.

When the pilot is about to take off the ground he realizes that his craft is not supported by the element in which he is going to fly and maneuver, but by its wheels and tail skid as it rests on the ground. From the moment he opens the throttle until his wheels leave the ground, the conditions of his support undergo a gradual translation, leading up, as it were, to the moment when he is completely air borne. During the translational period the aeroplane often shows characteristics alien to normal flight, which are apt to deceive the pilot as to what it is going to feel like in the air. Although the translation from ground to air conditions has been referred to as gradual, the process is further complicated because in practice the ground is rarely smooth enough to allow the pilot to get off without several bounces, which may disturb his well-laid plans. Neither can the pilot be said to have completed his getting off until he is climbing steadily well clear of the ground. As long as he is low down, the nearness of the ground exerts on his handling of the aeroplane a powerful influence, from which he cannot shake himself free until he is at least 1,000 ft. up. The whole process of getting off may roughly be divided into *three phases*: that in which the aeroplane is chiefly supported by the ground; that in which it is mainly air borne, but not uninfluenced by the contact of its wheels with the ground; and that in which it is wholly air borne, and the pilot is adjusting his flight to the condition of steady climb and getting clear of the ground.

Again, when the pilot flies his aeroplane towards the aerodrome to make a landing he realizes that, taking into account the angle of his glide, he must bring his aeroplane to a position close to the ground and in a condition of flight such that the translation from air to ground conditions may ensue immediately and in a kindly manner; and that, to reduce the chances of damage to a minimum and to use up the least space before coming to rest, the subsequent run, in which ground conditions prevail, will be as short as possible. In contradistinction to getting off, the process of landing may be divided into *two phases*: that in which the aeroplane is air borne and in which the pilot is adjusting his flight so as to ensure favorable conditions for approximation to and contact with the ground; and that in which the aeroplane runs along the ground before coming to rest. The modern idea of landing excludes the phase in which the aeroplane is allowed to run along the ground with the tail up. The first phase, though somewhat complex, is difficult to subdivide, for the onset of the influence of the ground is intimately bound up with the pilot's preliminary efforts to bring about conditions favorable to a good landing. Should these efforts have been ill-judged, the pilot's subsequent attempts at correction may serve rather to embarrass his landing than assist it; and what is more important, he is tempted to forget his rapidly receding powers of maneuver, and under the influence of the increasingly urgent necessity of reaching favorable conditions prior to contact with the ground, he may ask more of the aeroplane than it can give.

It is only when the pilot has yielded to this temptation that the relative frailty of the structure of an aeroplane is brought home to him; he then realizes how small a shock it need sustain to break, and how, if the maximum safe vertical drop on its wheels be small, a drop in which lateral or turning motion is included is many times smaller. Improvement of undercarriages in the properties of shock absorption and capacity to resist lateral loads may do much to mitigate errors in judgment, but it is well to emphasize how sure must be the pilot's judgment of the correct attitude of the aeroplane before contact with the ground is contemplated, when the speed at which he must necessarily be travelling and the possible unevenness of the contour of the ground is taken account of. The average pilot has to fly for some time before his sense of the translation from air to ground conditions is sufficiently vivid to make him really reliable. When he is air borne and clear of the ground in a highly controllable aeroplane, a mere bank of 20° or so is hardly differentiated in his mind from rectilinear flight, so distantly related is it to the limiting kind of maneuver which a pilot may not exceed without risk of breaking the aeroplane, and which is peculiarly confined to air handling. Not so when he is going to make contact with the ground. He is suddenly compelled to change his mental attitude towards the aeroplane; and this needs a distinct effort. Otherwise with a 20° bank on he may catch a wing-tip and turn the aeroplane on its back. A shock that the pilot hardly feels may be the prelude to a crash sufficient to "write off" the aeroplane. Many pilots, even those with considerable experience, have, after carrying out some violent "S" turns when maneuvering for position, suddenly realized that the ground is close and that the aeroplane is going to strike it; yet due to the persisting influence of air conditions have not made sufficiently drastic efforts to right the aeroplane, and so have crashed. The necessity of marshalling the aeroplane to a definite spot not only as regards position but as regards height, and, within small limits, of being at a definite speed at this spot, taken in conjunction with the sense of air freedom which the pilot has been enjoying, seems to constitute the psychological difficulty of landing well and safely.

3. Factors Which Influence "Getting Off" and "Landing"

The essential factor that influences the maneuvers of getting off and landing is the stalling speed of the aeroplane. The aeroplane must be somewhere near to the lowest speed at which flight can be maintained when its wheels leave the ground and when they again make contact with it. To this speed the pilot's mind subconsciously makes reference. Therefore the flying qualities of the aeroplane at and near stalling speed influence the getting off and landing very powerfully. In flight these qualities can always be felt as distinct from those at high speeds, but they vary in different types of aeroplane due to loading, stability characteristics and relative size of the aeroplane, on which three factors, assuming normally designed control surfaces, the control seems chiefly to depend. And it is with the control, which is built on these foundations, that the pilot is vitally concerned. In getting off, the relative power of the engine will also influence the flying qualities near stalling. Unfortunately, as is well known, the flying qualities near stalling make a bigger demand on the control than those in any other attitude of flight; but owing to the low air-speed, this is just what the control surfaces cannot afford. Simultaneously with maneuvering for favorable conditions, the pilot must be ready to counteract large disturbing forces. Therefore according to his skill and the qualities of his aeroplane he is compelled to leave himself a certain margin of speed in excess of stalling.

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* Lecture delivered before the British Aeronautical Society.

At stalling two unpleasant characteristics assert themselves; a large couple comes into play tending to put the nose down, and the aeroplane tends to become laterally highly unstable in straight flight; in other words the aeroplane at the full ebb of the pilot's controlling powers, does its utmost to bang its wheels or its wing on the ground. The pilot is naturally anxious to leave the ground as soon as he is air borne, because, even assuming there are no abnormal obstacles to surmount, he wishes to be at the maximum possible height over the edge of the aerodrome in case of engine trouble; if he allows the wheels to continue running over the ground at a speed greater than is absolutely necessary, the aeroplane is sure to be bumped about and the last phase of its get-off impaired: that is, when it reaches the edge of the aerodrome its height will have been reduced. At the same time the pilot dare not cut short prematurely the second phase of getting off while his controls are feeble and the disturbing forces large.

The foregoing remarks may be summed up by saying that the pilot always wishes, both in getting off and landing, to reduce the period in which his wheels are in contact with the ground and running over it, provided that in doing so he does not render the air-borne conditions just after or prior to contact with the ground so unfavorable as to be dangerous.

PART II.—"GETTING OFF"

1. Factors Which Particularly Influence "Getting Off"

The principal factors which influence the pilot's handling in the maneuver of getting off may be summarized thus:—

(*a*) The absolute dimensions of the aeroplane.
(*b*) The loading.
(*c*) The power of the engine or engines relative to the area and the weight.
(*d*) The position and effect of the propeller slipstream or slipstreams.
(*e*) The stability characteristics, assuming reasonable balance; and the effects of lack of balance.
(*f*) The control surfaces and their effectiveness, especially at low speeds.

Less important factors may be considered as:—

(*g*) The height, relative position and character of the undercarriage.
(*h*) The angle of the aeroplane to the ground with the tail down, and the height of the wings above the ground.
(*i*) The pilot's view of the ground, the contour of the fairing in front of him, and his position with regard to the C.G. and to the wings.

(*a*) In general, aeroplanes may be classified in size under four heads. The scout type, which includes aeroplanes of anything up to 300 sq. ft. in area; the larger single-engined two or three passenger type up to 800 sq. ft. in area; the twin-engined type up to 2,000 sq. ft. in area; and the large multi-engined aeroplane of 2,000 sq. ft. in area and upwards. The absolute dimensions give a fair measure of the liveliness of the aeroplane's motion in the air, and the magnitude of the control forces that the pilot may be called upon to exert. Small aeroplanes feel lively in the air, yet on the whole are the more readily controlled; large aeroplanes feel sluggish, but the control forces are greater and the response to the controls is slower. So for the inexperienced pilot, a medium sized aeroplane of 400 to 500 sq. ft. in area, which is reasonably handy without large control forces, presents the smallest difficulty in handling. With the smaller scouts the essence of the pilot's difficulty is that his mental response is frequently not commensurate with their inherent quickness; with twin and multi-engined aeroplanes that his physical response to opportunities of control is too feeble. And in getting an aeroplane off, as much if not more than at other times, these characteristics assert themselves. To appreciate rightly the quickness of the aeroplane's motion and the magnitude of its control forces, is the first requisite of safe maneuver close to the ground near stalling point.

(*b*) For many reasons both in war and peace the tendency to build comparatively heavily loaded aeroplanes is strong. Up to, say, 10 lbs. per sq. ft., the loading should not introduce serious difficulties. Assuming equal power, the heavier the loading, the longer is the run to get off, and the greater the demand on the pilot's skill in handling. The stalling speed is increased, and the aeroplane has to be travelling faster over the ground before leaving it, so allowing a smaller margin for the correction of errors of judgment. When the more heavily loaded aeroplane has actually left the ground with a reasonable margin of speed, it undoubtedly feels steadier than the more lightly loaded one. But once the loading rises to an unreasonable figure the control is seriously impaired; so that even under normal conditions with smooth ground and plenty of space the aeroplane becomes difficult to get off, and under severe conditions dangerous. If the loading is abnormally high, the large aeroplane is considerably worse to handle than the small one.

(*c*) The most notable, perhaps, of modern features in design is the greatly increased speed range of the aeroplane of today. This has in some measure been brought about by the increase in its aerodynamic efficiency, but more especially by the design of high power for weight aero engines. The influence of the possible speed range in getting off is of great importance. In the early aeroplanes which had barely enough power to maintain steady flight, when practically all the power the engine would give was used up in lifting the wheels clear of the ground, the acceleration was so gradual that the aeroplane ran over the ground for a long way bumping about in a degree of control that can best be described as questionable. Photographs of early aeroplanes getting off frequently show one wing dangerously dropped. Even when the aeroplane was off the ground, its height over the edge of the aerodrome was so small that the pilot was the whole time under the influence of the proximity of the ground. The saving condition of these aeroplanes was their extremely light loading. A heavily loaded under-powered aeroplane of medium size is worse; worse still is an under-powered heavily-loaded aeroplane of large size; which is what, in commercial aeroplanes, is most essentially to be avoided. The attainment in a flat calm of a definite height at a definite distance from rest with a good margin of speed and consequently of control should be rigidly insisted on, and this height and distance should be such that the pilot is quickly freed from the embarrassment of the ground; for safety, nothing ought to stand in the way of it.

Assuming that the engine were perfectly reliable and leaving out the question of economy, the relatively high-powered aeroplane, if not overloaded, is the safer in getting off. With the exception of intenser slipstream effects, the flying qualities near stalling seem to be improved; pilots sometimes describe such an aeroplane as "almost hanging on its propeller," in which saying there is some truth. With the under-powered aeroplane, the pilot is always tempted towards stalling in order to get off at all; and if partially stalled, he receives little assistance from his overburdened engine. Yet one thing to be remembered is this: if, in the high-powered aeroplane, the source of power does suddenly become extinct, the violence of the change of conditions corresponds with the power that is lost, and the pilot is left to contend with difficulties, not indeed so great as in the continual wrestling with an under-powered aeroplane when the engine is running, but greater than in the change of conditions if it fails.

(*d*) In most aeroplanes the pilot relies on the slipstream for a certain measure of longitudinal control during the first phase of getting off. That the pilot can do without, or very nearly so without its assistance is proved by the flying of some twin-engined aeroplanes. Most modern single-engined aeroplanes can be held tail down with engine full out at rest when the elevators are pulled up and the maximum negative incidence put on the adjustable tail; but there is certainly one that cannot. Nearly all twin-engined aeroplanes, on the other hand, would be pulled over on their noses by the engines under such conditions; if the tail is not held down only one engine can be run up at a time. The position of the undercarriage relative to the C.G. and to the thrust line, the angle of the tail relative to the thrust line and wing chord, and the size of the tail plane and elevators must be allowed for, but the practice in modern aeroplanes is similar enough for the above generalization to be made. It will readily be seen that if with throttle full open the tail can be held down at rest without artificial assistance, there will be no tendency for the aeroplane to tip over on to its nose in the first phase of getting off. On the other hand, if the tail cannot be held down, the pilot, before opening full out, has to be careful to allow the aeroplane to gather a little speed, by which time the wheels will have started moving and the aerodynamic forces which enable him to exert longitudinal control will be coming into play. He will then have reached the second phase. In one or two twin-engined aeroplanes in particular, the pilot feels the tipping tendency in the first phase in a marked way.

In all single-engined aeroplanes, the slipstream, besides acting on the tailplane and elevators, acts on the fin and rudder. In twin-engined aeroplanes also the fins and rudders are seldom uninfluenced. In getting off the rudder has frequently to be moved through its maximum angle, and its value as an organ of control is impressed on the pilot by the extent of its deterioration at low speeds. Although during the second phase the rudder control is gaining in effectiveness, not only is it necessary to cope with general disturbances, but is required to counteract a disturbing force which seems to attain its zenith during the second and the early part of the third phase of getting off; namely the effect of the rotating slipstream on the fin. If the propeller rotates anti-clockwise looked at from in front, there is a lateral force on the fin tending to turn the aeroplane to port; if the propeller rotates clockwise, the aeroplane tends to be turned to starboard. A similar turning tendency is also evident in twin-engined aeroplanes with propellers of the same sense of rotation. The onset of this disturbing force tends to be if anything more rapid than the corresponding increase in power of the rudder. To cope with this force the rudder has often to be used to its full extent, and is therefore of little use for counteracting the temporary and evanescent disturbances that co-exist with it. The above contentions are based on the assumption that the turning tendency is severe; at least they show that when an aeroplane is being designed, no effort should be spared to reduce the turning tendency as much as possible.

(*e*) I have said that in getting off, an appreciation of the flying qualities near stalling is of the greatest importance to the pilot. Nothing affects these qualities more than the character of the aeroplane's longitudinal and lateral stability.

In considering the stability of the aeroplane some sort of balance has to be assumed. Laterally the aeroplane is trimmed so that it is in balance with its wings parallel to the ground, although almost inevitably it will be out of trim when getting off due to the turning tendency caused by the slipstream on the fin. Longitudinally, the average pilot may be assumed to try to arrange the balance before starting so that the aeroplane will trim at its normal climbing speed. In the longitudinally stable aeroplane, as stalling speed is approached, there will be a couple tending to put the nose down; and the more stable the aeroplane is, the larger it will become. In the longitudinally unstable aeroplane which is in trim at some normal climbing speed, the tendency is for the aeroplane to put its nose up as stalling speed is approached; and, though of course it does appear ultimately, for the nose-diving couple to be longer delayed; general flying experience seems to indicate that the aeroplane can be partially stalled without its appearance, and that when it does appear it comes into play very violently and without warning. The stable aeroplane gives the pilot plenty of warning that it is going to put its nose down when near stalling; the unstable one is amenable to a stalling moment produced by the elevators; it seems to hang for a considerable period, until it suddenly dives. The delay in the automatic dropping of the nose allows time for lateral instability to develop in a more aggravated form, and the subsequent dive is frequently the first phase of a spin.

You may sometimes hear a pilot say, "I like to trim my aeroplane nose heavy for getting off," or another say, "I like to trim my aeroplane tail heavy for getting off," the idea presumably being that they would adjust the tail during the third phase of getting off so that the aeroplane would be in balance near its normal climbing speed. At first sight this discrepancy of opinion would seem to be without logical foundation, but there may be a reason for it. May it not be the pilot's instinctive provision for the behavior of the aeroplane due to its stability characteristics? The stable aeroplane is always trying to push its nose down near stalling, so the pilot wishes to make the aeroplane heavy getting off. The unstable aeroplane at its lower speeds tends to stall itself, and the pilot tries to arrange its unstable trimming speed so that throughout the major part of the speed range it feels nose heavy. He is thus subject to the smallest control forces.

(*To be continued*)

TRIALS OF SPERRY HIGH-LIFT WINGS

The Lawrence Sperry Aircraft Company of Farmingdale, who have designed and built for the commercial market a high-lift monoplane wing, which can be fitted to standard fuselages of the JN type, thereby greatly increasing the carrying performance of machines so equipped, requested the Aero Club of America to witness the trials in which an extraordinary load of five full weighted people, with a full load of gasoline were carried.

The Aero Club was represented by Mr. George W. Furlow and three other members, who all rode in the machine, in addition to the pilot, Mr. Lawrence B. Sperry.

The weights carried as officially recorded:

3 passengers	850 lbs.
Gas and oil for 2½ hours and instruments	150 lbs.
Total	1,000 lbs.

After loading the machine as above stated, three Air Service Officers kindly consented to witness the length of run that the machine took in getting off, and after measuring this, it was found to be 300 yards against a wind of approximately 5 miles per hour.

The first test was a climbing test, and the figures recorded by the Aero Club were 2,500 feet in 15 minutes.

The next test was the length of glide, which is one of the features of this machine. The glide with a full load was measured and it was found that the machine glided a distance of one mile and a quarter, losing only 600 feet altitude.

After this the speed test was put through between the water tower at Mitchel Field, and the water tower at Westbury, a distance of 1.99 miles, and although the wind was at an angle of approximately 15 degrees to the course, which effected a loss in the average speed, 85.5 miles an hour was officially registered.

The following official comments were made by the Aero Club of America: The machine taxied very well in calm air and also very well with the wind. The mahcine does not show a tendency to nose over. It made a fine Vertical Bank. The machine handles very well when taxiing with tail skid on the ground.

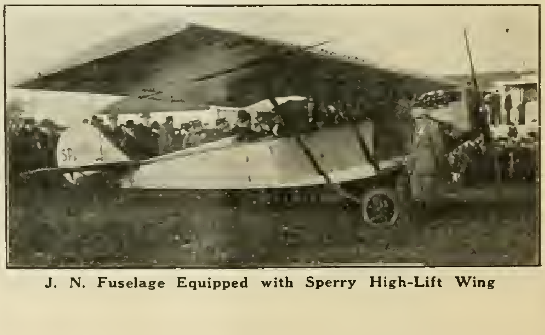
The Sperry high-lift wing, as was stated before, is designed to be used on any two-place fuselage, where a better all-around performance is desired.

The wing is so constructed that it is absolutely interchangeable from one machine to another. All that is necessary in order to mount it on a fuselage is to remove the four fuselage cabane strut fittings and replace them with special fittings supplied by the manufacturer. The fittings in turn take the Fokker type of struts.

The wing is internally braced and in one piece, completely free from external bracing wires, thus permitting very easy and quick erection and dismounting. Setting up the wing is such a quick and simple operation that it is practically impossible to make mistakes; there is no truing up or other delicate adjustments, so that highly skilled riggers are unnecessary. The wing is built up with very strong deep I beams, with solid spruce web and ash cap strips. The ribs are built up with 3-ply veneer with spruce caps, leading edge is spruce. The wing is covered with linen doped and varnished. It was sand tested, standing a factor of safety of 15 before failure with a deflection of 8 inches at a factor of safety of 6.

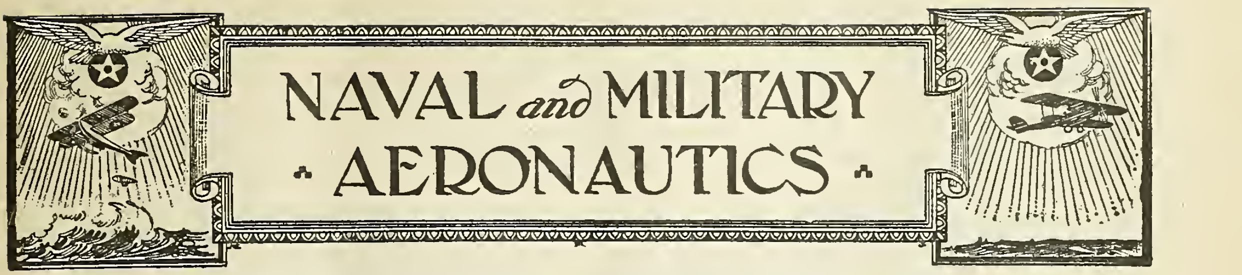
Principal Characteristics

Span	35 ft.
Length	26 ft.
Height	9 ft.
Wing area	300 sq. ft.
Weight, empty	1,350 lbs.
Useful load	800 lbs.
Weight, loaded	2,150 lbs.
Maximum speed	85 M.P.H.
Landing speed	42 M.P.H.
Climb with pilot and 1 passenger in 10 min	7,500 ft.
Climb with pilot and 4 passengers in 10 min	1,500 ft.
Radius of action	200 miles



J. N. Fuselage Equipped with Sperry High-Lift Wing

NAVAL *and* MILITARY AERONAUTICS



General Patrick Visits Langley Field via Airship C-2

Major General Mason M. Patrick, Chief of Air Service, accompanied by several other Air Service officers, experienced an interesting trip in the airship C-2 on October 18th from Bolling Field to Langley Field, flying as they did under unfavorable weather conditions with dense clouds close to the ground through which it was necessary to pass.

The airship left its base station, Aberdeen, Md., at 5:30 a. m., the crew consisting of Lieutenants Max F. Moyer and R. S. Olmsted, pilots; Major R. M. Jones, observer; two engineers, a radio operator and two rigging sergeants, and accomplished much of the trip to Bolling Field before daybreak. At the commencement of the trip the clouds were very low, and landmarks could not be distinguished until a point in the vicinity of Baltimore was reached. The compass course estimated before starting was maintained throughout and brought the ship directly to Bolling Field without any deviation therefrom. During this stage of the trip a head wind of about 15 miles per hour was encountered. The landing at Bolling Field was made at 7:30 a. m., and General Patrick, Major Oscar Westover, Major J. A. Mars and Lieutenant Courtney Whitney were taken aboard. Major R. M. Jones and one rigging sergeant here left the airship.

The C-2 took the air again at 7:50—its scheduled time for leaving—and started on the trip to Langley Field. Head winds estimated at from 15 to 20 miles per hour were encountered. The ground was visible during the first portion of the journey and until a point approximately 20 miles north from where the crossing of the Potomac River occurs when traveling in an air line to Langley Field, after which dense fogs were encountered, rendering it impossible to see the ground when flying at an altitude of 600 feet. To avoid the possibility of striking hills or other objects, the airship ascended higher and maintained an altitude of from 800 to 1,000 feet for the remainder of the trip. Dense clouds were rolling along the surface of the ground, and it was not until about an hour and a half of flying through the fog that the ground was visible again, except for a brief interval when the ship crossed the Potomac River. At a point in the vicinity of the Rappahannock River the fog dissipated somewhat, and thereafter the ground was visible. During the flight through the fog the wind changed to a more easterly direction and veered the ship some 8 to 10 miles off its course.

After some difficulty upon emerging from the fog, the exact position of the ship was ascertained, and the remainder of the trip was uneventful save for the loss of about 15 minutes' time due to one of the engines cutting out on account of an oil pressure line vibrating itself loose upon the right motor, and shortly thereafter when both engines cut out due to the non-functioning (float valve clogged up, requiring adjustment) of the sump tank into which the main gasoline tanks of the airship drain. The practicability of carrying out minor repairs upon an airship during flight was demonstrated in these two emergencies; in the instance of the oil line Sergeant Nolan was able, after cutting out the motor involved, to crawl out upon the engine gantry and thereby reach and tighten the offending, loose, oil pressure line. The line effected was that running from the oil tank to the pump. In the instance of the gasoline feed trouble, both motors involuntarily cut out for lack of gasoline supply systems.

There is a small tank of approximately five gallons capacity located in the extreme bottom of the car below the level of all three gasoline storage tanks. Gasoline flows into this tank equipped with a float check valve, which is filled by gravity from the main tanks. In the slip stream and close to the propellers upon either side of the car are located two Robinson cup type propellers which operate a pump, forcing the gasoline from the small tank above referred to up into another relatively small tank located above the level of the carburetors and midway between the motors. This is the first instance on record of this simple and effective gasoline supply system, above described, clogging up. Hang gasoline pumps permanently installed and provided for just such emergencies were operated after it had been ascertained that the trouble lay in the non-functioning of the sump tank. In each of the two above instances when the motors cut out, the ship was found to be in almost perfect equilibrium.

At a point approaching the York River planes from Langley Field, consisting of three DH4's and one heavy bomber, met the airship, forming an escort for the remaining distance to Langley Field. The airship landed at Langley Field at 12:50 p. m.

In the afternoon, at 3:00 p. m., the airship with all passengers carried on the down trip, and in addition with Lieutenant George F. Parris aboard, took off for the return trip to Bolling Field, which was accomplished without incident, the visibility being good. A wind of about 15 miles from the southeast helped to speed up the trip very materially, and the landing at Bolling Field was made at 5:15 p. m., when General Patrick, Major Westover, Major Mars and Lieutenant Whitney disembarked, and 15 minutes later the ship took the air once more upon the last lap of the trip to Aberdeen, Md., taking on as passengers Lieutenants Wm. E. Connolly and Earle J. Carpenter. It was dusk when the ship reached the District Line, and the remainder of the trip was made in gradually increasing darkness. When passing over Edgewood Arsenal, the airship hangar at Aberdeen Proving Grounds, well provided with lights, was seen. Landing at Aberdeen was made at 6:50 p. m., without incident.

As a whole, the trip was a pronounced success, and all occupants of the ship had ample opportunity to judge the characteristics of flight in a small airship under dense foggy conditions. At one time, when it was thought likely that it would be necessary to land at Langley Field in the fog, which was then rolling directly upon the ground and of sufficient density to preclude the possibility of seeing the ground from a greater altitude than 50 feet, a radio communication was obtained from Langley Field to the effect that a ceiling of 900 feet obtained at that field. This news proved somewhat of a disappointment to the crew of the airship, as they believed it would have been very interesting to have located Langley Field at the end of a four to five hours' run in such a fog and make a successful landing. Under such conditions a captive balloon at 3,000 feet altitude would definitely have located the field, as the upper limit of the fog was not over 2,000 feet, and such a balloon could have been seen at distances in excess of 20 miles. Another very effective method would have been to arrange a smudge pot at Langley Field, throwing up a great column of hot smoke, plainly visible under average conditions to altitudes of three and four thousand feet. The Italians used this last method during the war on the Austrian front very effectively.

The C-2 is a non-rigid airship, powered by two 150 h.p. Hispano I engines. Its length is 192 feet, maximum diameter 54 feet, capacity 181,000 cubic feet, and it is capable of attaining a speed of 60 miles per hour.

With the advent of the "Roma" into active Army Air Service flying, flights similar to the above under practically any weather conditions and for greatly extended distances will be perfectly feasible. Comfort, reliability and remarkably fast time for the longer distances will be assured. Frequent runs to the Pacific Coast from Langley Field, the home of the "Roma," are perfectly practicable, and such a run as General Patrick took in the C-2 from Washington to Langley Field and return will doubtless find its magnified and improved counterpart in a not distant future run from Washington to Los Angeles and return.

While at Langley Field General Patrick and Major Westover inspected the airship "Roma," which was found to be about 73% erected and fast approaching completion. General Patrick evinced great interest throughout the trip in the meteorological conditions prevailing and in the operation of the airship and its general performance. On alighting at Bolling Field he expressed himself as well pleased with the trip.

Two Army Fliers Killed

Honolulu.—Lieut. Ulric Bouquet of Brooklyn and Staff Sergeant Vernon E. Vickers of Montgomery, Ala., were killed October 26 when their aeroplane broke into flames while they were attempting to join a flight formation at a 2,000 feet altitude. The bodies and aeroplane were badly burned.

Lieut. Bouquet was 31 years old and commanded an intelligence unit. The accident occurred at 8:36 a. m., the exact hour that Major Sheldon Wheeler was killed in a similar accident here last July, according to air service officers here.

FOREIGN NEWS

Aviation in France

It is understood that the Franco-Roumaine Air Line contemplates a regular service to Constantinople next Spring. It seems an ambitious project at present, but in five stages, with stops at Strashourg, Prague, Budapest and Bucharest it should be quite possible and could be accomplished in 24 hours. This will be an important step in the accomplishment of the air route to the East. Moreover, the country is nearly all the way excellent for flying.

It is understood that the French firm of Farman Freres have under construction the biggest "air liner" yet produced. It is said to have a span of 58 metres and to have four engines, probably Lorraine-Dietrichs, Hispanos or Renaults. Or perhaps the report that the French are to build Napiers may have some connection with this machine. The machine is said to be destined for the Cie Grands Express Aeriens for the Paris-London service.

Swedish Aero Show

Reports from Sweden indicate that it is intended to hold an Aero Show in Goteborg, Sweden, in 1923. The time tentatively fixed for the Exhibition is July 7-31. It is stated that the Society of British Aircraft Constructors and the Chambre Sydincale des Industries Aeronautiques (France) have been approached on the subject of participation in the Exhibition and have given favorable replies. It is also hoped that Italy, Germany, Czecho-Slovakia and the United States will participate.

British Airship Policy

An order has been issued directing that the R. A. F. Airship Base at Howden, Yorks, be closed down not later than March 31st next. This order is in conformity with the policy already announced of ceasing all further activities with airships for Service purposes, owing to the necessity for the utmost economy, and making existing airships available for civil operation. The airship personnel is being transferred to other branches of the R. A. F., and a number of officers from Howden have already begun courses of instruction in order to fit themselves for new duties.

Passenger Carrying Record

Mr. O. P. Jones, a commercial pilot, must now hold the record for number of passengers carried by one pilot. Recently he passed the 10,000 mark, and it seems improbable that any other pilot has carried as many as 10,000 passengers. Mr. Jones began his work as a "joy ride" pilot in February, 1920, and his total to October 2nd was 10,100. His Avro G.EASF has carried 8,000 passengers, which must be a record for small machines. He has visited over thirty different towns all over Great Britain, and has made return visits to some. He has given exhibitions and joy rides from all conceivable sites and in all kinds of weather.

Australian Aerial Mail

The first of the series of aerial mail services in Australia under control of the Commonwealth will be inaugurated on October 30th, or, if subsequently fixed by the Minister of Defense, not later than November 30th. While a limit of £25,000 has been placed by the government on the total amount of any tender, tenderers are to be given the option in forwarding parcels to maintain a greater or less number of trips than is provided in the conditions-contract. Tenderers must name two guarantees to the amount of £5,000 for safety of mails and fulfillment of contract, and must specify the class of machines, number proposed to be provided, with their speed, radius, petrol consumption, carrying capacity, etc. The scale of charges for passengers and freight will be subject to the Minister's approval.

Mushroom Hunt by Aeroplane

Going mushroom-picking by aeroplane is the latest idea, according to the London *Evening News*.

Mr. A. S. Keep, chief pilot of the Westland Aircraft Company at Yeovil, likes mushrooms so much that when all the known places were found to be barren he decided to go aloft and "observe." He had almost "worn himself to a shadow" walking round the country. Mr. Keep started off in his machine and, flying at a height of 50 feet, suddenly saw a field with small white dots. He promptly landed and found himself in a veritable nursery of mushrooms. In a short time he had collected about 8 pounds, which he put in the cabin of the plane and flew home rejoicing.

Changes at the British Air Ministry

It is now generally known among those who are in touch with R. A. F. movements that the term of office of Air Commodore Brooke-Popham as Director of Research at the Air Ministry will shortly expire, and that he will then take up the post of Commandant at the R. A. F. Staff College, at Andover, for which he is particularly suited by his thoroughness and assiduity in whatever task he undertakes. It is understood that his successor as Director of Research will be Brigadier-General R. K. Bagnall-Wild, at present Director of Aeronautical Inspection.

General Bagnall-Wild was originally a Sapper Officer, and has therefore had a thorough technical training in his youth. After leaving the Army he was connected with the motor trade for some years, and joined the Aeronautical Inspection Department in its early days, when the late lamented Major J. D. P. Fulton was chief of that Department. General Bagnall-Wild's interest in and capacity for research work was shown by the excellent display made by the A.I.D. under his direction at the last Aero Show. Everybody will wish him in the Department of Research the same success which he has attained in the Aeronautical Inspection Department.

General Bagnall-Wild will be succeeded by Air Commodore Halahan, now Deputy-Director of Equipment.

A Helicopter Accident

An experimental helicopter, piloted by Lieut. de Payer, collapsed at a height alleged to be 600 feet, between Puteaux and Suresnes on October 7th. The pilot was seriously injured.

Further particulars, if of interest, will be published when they are available.

The British Airship Situation

Major C. C. Turner makes the following interesting comment on the British airship situation in the London *Observer*.

For the good name of airships it is deplorable that the impression has been created that the actual cause of the break-up of the R38 is unascertainable. One must take due note of ordinary comment on this affair, and that is, that no matter how much the R38 in particular and airships in general be extolled, it is obvious that the safety factor is too small. The intending airship passenger and the commercial man who is asked to finance airships, rightly enough, from their point of view, experience a shattering of any confidence they may have felt. For if the admittedly high technical skill displayed in the design and construction of this ship failed to avert so appalling a disaster, where do they stand?

On the face of it this appears to be shrewd criticism. Nevertheless, the present writer ventures to suggest it is fallacious. The R38 was a novel type designed to possess an unprecedented combination of capabilities. Not only was she designed for war; she was designed for warfare of a particular character.

Because the coroner's court could attribute the disaster to no specific cause it must not be assumed that the Aeronautical Research Committee which is still sitting have not already learned important facts; and quite probably all these facts will not be divulged. It must be remembered that the R38 was a war airship, and in its design the United States as well as Great Britain was interested, so that secrets, whether of success or of failure, will rightly be guarded. How near she was to being a great trimuph is now perfectly well known, and this is the more remarkable for a ship built not only to surpass the great altitude capacity of the latest German airships, but at the same time to possess (although this does not appear to have been mentioned at the inquest) far greater duration and range. In the endeavor to secure these results there were important departures from Zeppelin practice: notably in dividing the gas-holder into fourteen instead of nineteen or twenty separate compartments; whereas in the smallest Zeppelins ever built there were seventeen.

It would be easy to be wise after the event. It was extremely unfortunate that during her last trial, and before she had been passed over to the Air Ministry, so many people were on board. On the other hand, during that last voyage she passed successfully through exacting tests. Nor, apparently, did the collapse occur while she was traveling at her highest air-speed, 60 knots, or 68½ miles per hour.

Whatever her previous history may have been, there appears to have been some reason for the satisfaction and confidence felt by those responsible on that unhappy day.

Many people desire and profess to believe that this disaster has put a check to airship development, and that the country is heartily sick of it. This is a suggestion of cowardice and weakness unworthy of Great Britain. If the same had ruled in the past we should have no ships, no railways, no motor-cars, to-day. So far as any bearing on the general airship proposition is concerned, the R38 disaster simply does not count.

But those who imagine it is the end of airships are sadly mistaken. The Admiralty will develop airships. It will be remembered that the Admiralty reluctantly decided to give up airships for reasons of economy, and after reference to the political situation. It was felt that for the present the big flying-boat and the deck and torpedo-plane would suffice for defence. That decision, however, was come to in the full belief that the Air Ministry would dispose of airships to a commercial concern, and that a certain amount of airship work would be carried on, including all-important training. This has not actually fallen through, and it is significant that the airship bases are still retained.

The question has, however, been given an altogether different complexion, and, in brief, the Admiralty have decided that they cannot afford to permit the complete abandonment of airship work. The Admiralty never was satisfied with the former arrangement, under which airships and crews were lent by the Air Ministry to the senior service; and will not return to it. In the course of a few months the public will learn that the Admiralty will carry on certain building and experimental airship work.

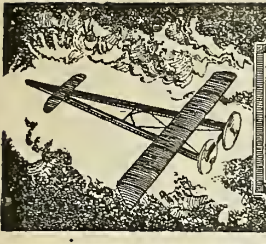
Again, it has lately been asserted that all airship research in this country is now at a standstill. This is not the case. Under the Air Estimates there is a special allocation of £7,000 for airship research at Farnborough, and valuable work is also being carried on at the National Physical Laboratory. It is, of course, very important that money so allocated shall be spent to the best advantage, and that overlapping should be avoided, for the country cannot afford to waste money. Scientific research is already being starved in all directions, and it is the more urgent, therefore, that counsels of confusion or extravagance should be resisted.

But this country will make a deplorable mistake if it consent to an abandonment of aeronautical work in any direction. Other countries are pressing ahead, and are already overtaking us in the long lead we won during the war. Germany is working hard. And every day the vital importance of air power is more clearly shown. In Mesopotamia our military control is through the air, under the command of a Vice-Marshal of the Royal Air Force. Let the nation take heed and realize that the air will be the determining element in the next war.

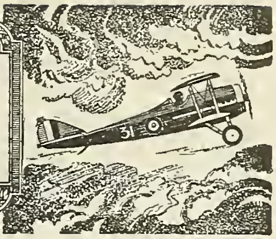
Brazilian Activities

The Directoria de Meteorologia e Astronomia of the Brazilian Department of Agriculture has been divided into two separate services, that of meteorology and the National Observatory. The meteorological service will continue the climatical work, established in 1919, standardizing the methods of all meteorological activities in the country and publishing all available data for the last 10 years. It will also establish a forecast service for central and southern Brazil; an aerological service for aviators and for the general progress of meteorological science creating kite and pilot balloon stations; a special coast service for navigation; agricultural and marine meteorology services; a special service of rains and floods; and the usual investigations in every department of meteorology, which may possibly lead to longer ranges in forecasting weather.

An important aerial transport company has been formed in Rio Grande do Sul for regular passenger and freight service between that city and distributing centers in the various neighboring states. The machines are of French manufacture.



ELEMENTARY AERONAUTICS *and* MODEL NOTES



The Seesock-Dayko Sport Aeroplane

LIGHT plane builders should be encouraged by the success of Frank R. Seesock and Derza Dayko, both of 722 Catherine Street, Perth Amboy, N. J., who have built an Anzani engined plane which was flown on October 9th by a professional pilot. The builders obtained the data for the design and construction from various descriptions published in Aerial Age and are high in their praise of the magazine as a medium for practical information.

The machine's dimensions are as follows:

Dimensions

Span	19 feet 2 inches
Chord	3 feet 0 inches
Gap	3 feet 0 inches
Length overall	15 feet 2 inches
Height overall	6 feet 1 inch
Weight, empty	309 pounds
Weight, loaded	552 pounds

Areas

Main wings	108 square feet
Stabilizer	12 square feet
Elevators	10.6 square feet
Ailerons	12 square feet
Fin	2 square feet
Rudder	6 square feet

Main Planes

The wings are built according to the conventional standard practice but the wing beams are solid. The rib webs are of plywood capped with spruce.

Ribs are [illegible] ns are 1⅛ inches by [illegible] 1⅛ by 2⅞ inches.

In place [illegible] wires, plywood is us[illegible]

Both fly[illegible] randed cable, crossed to act as [illegible] es are ⅛ inch stranded cable.

pri e eal
list. inches an our price list toda
JOHNSON AIRPLANE

Wing hinges are similar to the Curtiss "Jennie" with a 16 gauge steel strap running from one side of the body to the other and to which also are attached the flying wires.

The center section struts are of 1-inch 16-gauge steel tubing in the form of the letter H, the horizontal member being brazed to the struts near their upper ends. This form of strut does away with the necessity of incidence cables between the center section struts.

Fuselage

The body is of the usual four longeron type covered entirely with three-ply veneer. Plywood is used to bind all the corners, attached by means of glue and screws. No wires are used in the body bracing.

Longerons, of spruce, are of constant section, 1⅛ inch square.

The forward bulkhead is covered with 16-gauge aluminum which acts as a fire board, as well as a cross brace.

Controls

The stick control consists of a 1-inch 16-gauge steel tube, the lower end of which fits into a U shaped fitting welded on a cross-tube. Aileron wires are connected directly to the control stick. On the cross-tube, half horns are welded for the operation of the elevators. The lifting elevator wires go forward to a pulley behind the rudder foot-bar, thence back to the elevators. The lowering wires go direct from the stick to the elevators.

Empennage

The empennage or tail group has surfaces which are large in proportion to the size of the machine to insure effectiveness of control. The stabilizer is adjustable four degrees positive or negative so that any disturbance of the balance can be easily remedied.

Landing Gear

The V struts are of ash of a 3-inch by 1-inch section. The axle attachment is similar to the Graham-White "Bantam."

Engine and Engine Mount

An Anzani type C. 6 six-cylinder air-cooled engine is used. At 1,325 revolutions per minute this engine develops 55 horsepower. In the test runs, the engine was run as high as 1,495 r.p.m.

The propeller is 6 feet in diameter. It has a 6-foot-2-inch pitch.

The fuel tank is divided into two compartments, the front portion of which can hold two gallons of oil and the rear part thirteen gallons of gasoline. This quantity of fuel is sufficient for a flight of 2½ hours' duration.

The engine mount is the Bellanca type having two 12-inch wings of 16-gauge steel on each side of the body. Four ⅝-inch steel tube arms extend from the ends of the longerons to the rear of the engine and attach to the crankcase bolts. The engine bed is reinforced by four steel straps, crossed from the sides of the body.

Performance

The high speed of the machine was estimated by the pilot to be well over 90 miles an hour. On the trial flight the engine was not working at its best or even greater speed might have been possible. The pilot reported the balance to be very good. Other performance tests are to be made in the near future.

How E. M. Laird Built and Flew a 12 Horsepower Plane in 1913

As with many other pioneers, E. M. Laird, at the time he built his first plane, was not a pilot and had never even had a passenger ride in an aeroplane. Therefore, after building his first plane, he really taught himself to fly.

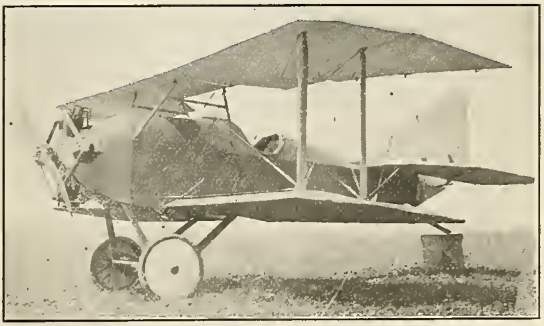
A point which impressed him and which was finally the cause of building his machine was the lack of efficiency of the aeroplanes of that day. He proceeded to apply his rather revolutionary ideas by building a plane designed not only to fly but one that would give the desired performance with one-third the horsepower used by other planes of equal size.

The plane was completed in 1913 and assembled at Cicero Field, Chicago. It was powered with a four-cylinder vertical air-cooled engine of original design. The cylinders had a bore of 3⅛ inches and a stroke of 3¾ inches. At 1,150 r.p.m. it developed 12 horsepower.

Like all other new machines of the day, its appearance naturally aroused a great deal of interest and was closely inspected by many experienced aviators and builders. It was their universal opinion (and some of these men are prominently identified with the present-day aircraft industry), that it would be impossible to even get off the ground with so little horsepower. After a few months of self-instruction in flying Laird attempted the initial flight of his new machine. To the surprise of his critics the machine did more than merely get off the ground: it made flights equal to those of machines with triple the horsepower. After seeing the machine perform, the same experts looked upon it as a revelation and hailed it as a real achievement in aeronautical development.

At that time the only possible means of income from an aeroplane was in giving exhibition flights, so with this little plane Laird travelled over five states. However, with the introduction of the loop-the-loop and stunt flying by Beachey in America and Pegoud in France, a heavier ship was demanded, so Laird then designed and built a machine that did the work with a six-cylinder 45-horsepower engine, again making a successful exhibition tour. This later machine was used the following winter by the famous woman flyer, Katherine Stinson, on her trip through the Orient, giving exhibitions in Tokio, Yokohama and other cities.

Early in 1917, Laird was called upon to act as a flying instructor and did no further construction work until the close of the war. His latest commercial ship is the Laird "Swallow" which uses a 90-horsepower Curtiss engine, designed to give the required performance on a minimum of power, thereby reducing the operating cost.



An Anzani Engined Plane built by Messrs. Seesock and Dayko from data gathered from Aerial Age

In Days Gone By

Said the bridegroom to the gloomy-looking man: "Well, old man, have you kissed the bride?"

"Not lately," replied the g. l. m. as he passed out into the starry night.—*Wampus.*

Spic: My fiancee insists that I obtain her a large bouquet for the dance tonight. Is it being done?

Span: No, you are.—*Tiger.*

Kissing, with Apologies to "Sing"

Kissing is a wicked pleasure,
I like it.
It causes grief beyond measure,
I like it.
It makes you bold, it makes you bad,
It drives you crazy, makes you mad,
It's the worst blame thing that can be had.
I like it.

Playing the Game

I hope there'll be a judgment day
So folks will understand
I played the game almighty fair—
Just made the best of my two pair,
With "three" in neighbor's hand.

I didn't try to steal the pot,
Though neighbor thinks he knows
Just how he called my "little bluff"
The time he won the precious stuff
And so of course it goes.

Perhaps when cards are dealt last round
And I and neighbor play
When waiting at the Golden Gate
I'll find a flush to beat his straight
Held pat on show-down day!

Souvenirs

"Aw git away, Kid, I'm saving my kisses!"

"If that's the case, I'd like to contribute to your collection."
—*Tar Baby.*

High Priced

The Fair One: I see here where a man married a woman for money. You wouldn't marry me for money, would you?

The Square One: Why, no, I wouldn't marry you for all the money in the world.—*Tar Baby.*

How About It?

It is rumored that there is a case of Haig and Haig in Brattle Square. A subscription has been started so that John the Yard Cop can take a short vacation in Africa.—*Harvard Magazine.*

Chem.: What's all the riot in the Anatomy building?

C. E.: Oh, just the medical students rolling the bones.
—*Pelican.*

Small Son: Hey, pop, why do they have clocks on socks?

Proud Parent: So they can see how fast the seams run.
—*Lyre.*

"You say Gillis doesn't have much of a line?"

"Naw, why he can't even string a banjo."—*Froth.*

"Grabbie" voices the sentiment of the whole college when he kicks on Terry's leaving University for the news-stand of the Union. University Hall will seem empty without Terry and the ever-present cigar, and besides there isn't a chance now to have a Union charge slip lost, strayed or stolen.
—*Harvard Magazine.*

A Dante Joke

Mrs. Dante: What are you writing about now, dear?

Dante: Oh, Hell, you wouldn't understand it.
—*Harvard Magazine.*

No Smoking

Ann: Have you stopped smoking?

Van: Yes, I had to. A fellow can't get a good cigar on the campus any more. It is too muddy.—*Chaparral.*

"Why do you seem so fussed?"

"Oh, I always feel self-conscious in an evening gown."

"Sort of all dressed up and no place to go?"

"No. * * * Nothing on for the evening."—*Frivol.*

"I want commercial reform," screeched the speaker at the Liberal Club, "I want educational reform; I want political reform; I want—"

"Chloroform," yelled the audience.—*Harvard Magazine.*

Hypocrite

He (*making the time-worn excuse*): I'm afraid we'll have to stop here; the engine's getting pretty warm.

Fair Companion: You men are such hypocrites; you always say "the engine."—*Colgate Banter.*

Melodrama

Heroine: What are those shrieks?

Villain (*relentlessly*): They have tied an American to a chair and are showing him a bottle of Scotch.
—*Passing Show (London), from a Play.*

[illegible]
her previ[illegible]history [illegible]—
eason for the satisfaction [illegible] confidence fel[illegible]
that unhappy day.
e desire and profess to believe that this disaste
ip development, and that the country is heartil
gestion of cowardice and weakness unworth
same had ruled in the past we should have
tor-cars, to-day. So far as any bearing on
n is concerned, the R38 disaster si[illegible]
[illegible] is the end of [illegible] fruit
Then cloth[illegible] in style.
We'll have to pass the fruit again
In a short, short while.—*Sun Dodger.*

The Mail Pilot

Over the city, hill and dale,
Through the empty spaces of the sky,
The pilot wings his way with mail
On those man-made wings on high.

Seated in his wing'ed steed,
On frail linen wings is he borne
Through the air with all possible speed,
Through the wind and rain and the storm.

Planes heavy-laden with costly bales
Roar and resound through the fathomless sky,
Pilots with their precious mails
Are carried daily on high.

And so the mails continue to go
Swiftly and safely through the air,
Over the trodden earth below,
Over the slower things down there.—*Contact.*

Miriam: "Did you take the picture of the young man on the mantel?"

Mildred: "Yes."

Miriam: "Friend of yours, I suppose?"

Mildred: "Well, he was before I took the picture."—*The Squib.*

Aye, There's the Rub

It isn't the can that annoys the dog,
It's the fact that it's tied to his tail.
It isn't your subjects that make life hard,
It's the number of them that you fail.

It isn't the time you waste on her,
Nor the thriftless gold you spend,
But the cold and unrelenting jolt
She hands you in the end.—*Virginia Reel.*

AN OPEN LETTER, to the users of Aircraft material

A YEAR ago the JOHNSON AIRPLANE AND SUPPLY COMPANY started to build a thoroughly modern and up to date Aviation Supply Station in Dayton, Ohio, for the purpose of supplying service to pilots, builders, and experimenters; and selling planes, motors, parts, and accessories.

Today we have over 25,000 square feet of floor space in modern hangars, shops and stockroom, a large flying field in connection; all situated two miles from the center of Dayton on the Wilmington Pike, where any type of plane can land and receive professional service. Our Service Department is in charge of men whose knowledge and experience with American and Foreign planes has been constant since 1914.

Few people realize our stock rooms of over 18,000 square feet of floor space contain a larger assortment of aeronautical equipment than any other commercial aviation company in the country, as it includes American and Foreign planes set up and ready to fly, and all types of motors. To give real service to the buyers of these planes and motors we carry a complete stock of spares; including parts for Anzani 90 and 50 H.P., Beardmore 160, Benz 220, Clerget 110 and 130, Curtiss OX-5, Fiat 300, Gnome 100; Hispano 150 and 300, Le Rhone 80 or 110, and Mercedes; also complete plane parts at very low prices for Curtiss D, Canadian, Standard, and De Haviland 4. These include linen or cotton covers made up for all surfaces, propellers, radiators, landing gears, struts, fittings, wind shields, cowls, safety belts, seats and cushions, speaking tubes, goggles, flying clothing, instruments, including Bosch switches for twin motored planes, gas tanks including center section tanks, booster starters, etc.

The enormous volume of business we have done in the past year has been due chiefly to an understanding of your needs; our central location; prompt intelligent service coupled with our desire to make you our regular customer; and helping to foster the business of commercial aviation by selling you aircraft material at lowest possible prices.

Our Information Bureau is always at your service.

Our latest price sheet has just been issued, although not a complete list, as new parts are coming in every day. Motor parts are not itemized but sufficient to say we have every part of most aviation motors, and at new reduced prices. We earnestly solicit your next order. Let us put your name on our mailing list. Write for our price list today.

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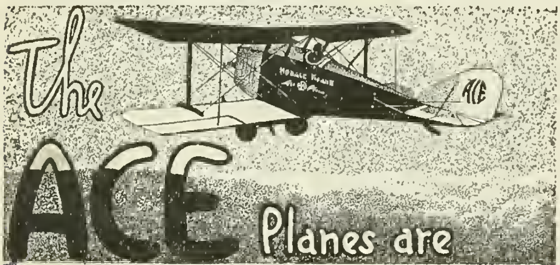

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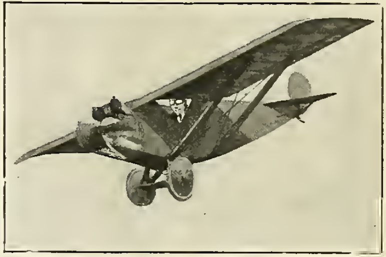

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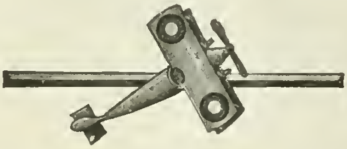

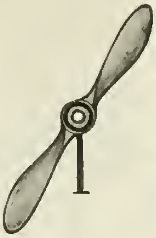

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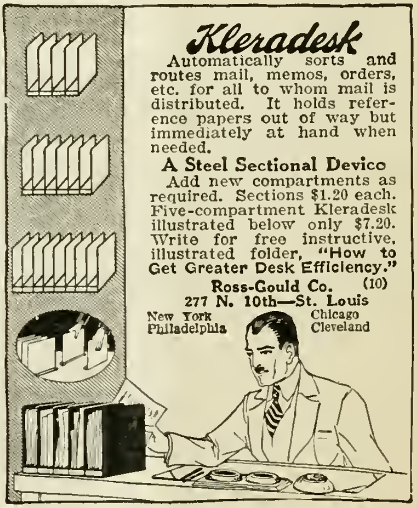

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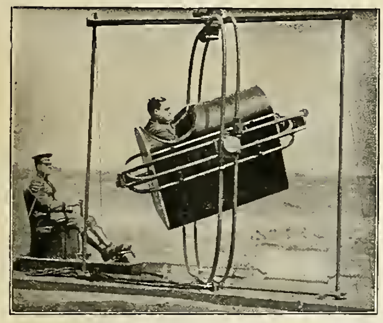

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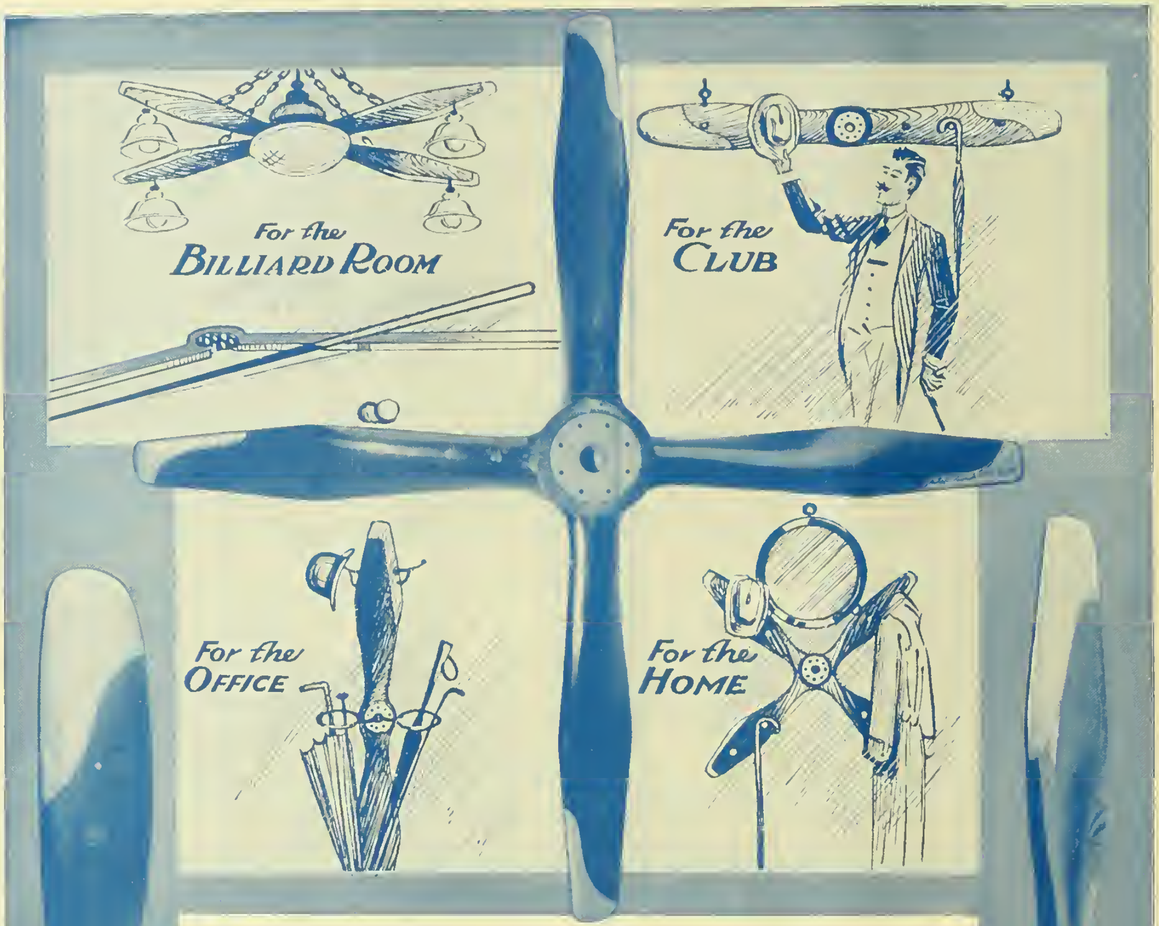

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Fundamental Principles in Aeroplane Design

THE purpose of the editorials appearing in AERIAL AGE which are of a technical nature is to present in a simple, direct manner certain basic principles in aeroplane design. Oftentimes this can better be done in a short technical editorial, where only the kernel can be given, than in a longer article in which the true substance is sometimes obscured by a mass of highly technical language.

The object of every aeroplane is to give a high performance. The nature of the desired performance depends upon the type of aeroplane under discussion. The Government's proposed single-seater alert type in which very high rate of climb is of paramount importance, and Fokker's F-3 in which high carrying capacity and economy of operation are essential, are contrasting types. In military types of the pursuit class, the great requirement is maneuverability. The question facing the designer is, "How may the characteristic which is most desired in any particular design be obtained to a maximum degree, and how will the other characteristics be affected?" This question must be answered quantitatively if the best results are to be obtained.

Performance depends upon five basic things: pounds per square foot, pounds per horsepower, fineness, engine-propeller factor, and wing profile. Within certain limits the designer is free to vary each of these quantities. The proper method of procedure is to hold all but one variable constant and to determine what effect different values of this variable have on the performance characteristics. Aeroplane design is always a compromise, and in securing a high degree of any one quality some sacrifice must be made. The quantitative analysis suggested shows just how far it pays to go in obtaining the desired characteristics. For instance, suppose excellent climb and ceiling characteristics are wanted, the most direct method to gain them is to increase the wing area. This, of course, adds to the weight, the span, the length and moment of inertia, and decreases the speed. Owing to the influence of fineness the change in speed is not appreciable except with large changes in wing area. Starting with a very high wing loading it will be observed that the improvement in the climb and ceiling is very great for each increment of area. But as the area becomes greater the ratio of improvement becomes less. Furthermore, most of the disadvantages are much less affected with each decrease in loading when the loading is high than when it becomes moderate. A point is finally reached when the addition of wing area causes as great a loss as a gain. Here the maximum efficiency for the design is reached. Only a quantitative study will enable an engineer to more than merely guess at the correct wing loading.

A similar procedure can be gone through with the weights. For example, one type of construction may be much cheaper but heavier than another. To determine which is the better it is necessary to calculate the performance with each weight. Or, assume that it is very desirable to increase the disposable load. The day should have long passed when anyone would say that an increase in load would not affect the performance and maneuverability. The question is, how much are these affected? With military types the addition of equipment or fuel on an existing aeroplane causes such a marked decrease in performance and maneuverability that very soon the pilot decides he would rather do without the additional armament or radius of action. This very situation has arisen within the past year in the case of our own army aeroplanes. It is unnecessary, however, to wait for flight tests. The effect of a variation in weight can be accurately foretold.

In the same way the influences of varying horsepower and fineness can be studied. By determining the effect of the first variable the selection of the right engine for the particular design can be made. A later editorial will discuss more fully this special question. As brought out in last week's column, the influence of fineness very greatly reduces the value of the Handley-Page slotted wing unless decreased landing speed is the only advantage sought. An even more practical case comes to mind. If, before the Post Office Department had decided to rebuild a number of the DH-4's, making them into a twin-engined job with two nacelles in the wing, they had known what effect this would have on the fineness the idea would have been discarded before the work was done, rather than afterwards, with a large saving of money.

The design and performance charts developed by Mr. Kerber are extremely valuable in studying these different questions. They have been published as Air Service Information Circular Vol. II, No. 183. A limited supply is available in Washington. These charts are not suited for accurate use with wing sections other than the R.A.F.15. It is hoped that before long Mr. Kerber's modification of them, allowing for the effect of any known wing profile, will be published.

These are some suggestions to improve our design work in this country. They show the necessity for a trained engineer and for lots of work on his part. The day of the designer who works by instinct or intuition has passed. Competition has made the work too complex. There is more need, however, for sound judgment than ever before to pass on the facts obtained by analysis.—B. C. B.

THE NEWS OF THE WEEK

Roma Is Ready

The Roma, America's largest airship, is now ready to make her maiden flight in this country. For several months the big ship has been under construction in the big airship hangar at Langley Field. Now she awaits the word which will open the giant doors of her berth and release her anchorage preparatory to the test flight which will later be followed by an exhibition and trial flight or cruise.

A special docking rail is being constructed leading from the landing field to the hangar. The first flight will probably be made before this feature is completed, although it will be necessary to call upon the entire personnel of the Field to handle the ship with security when this mechanical arrangement is not utilized.

The thousands who have watched with interest the construction of the airship and hope to see her in flight will appreciate the statement for which Major Thornell, who is in command of the Roma, is authority, that at least twenty-four hours' notice will be given the residents of Langley Field and vicinity of the time of the first flight of the big ship.

The crew of the Roma will consist of from twelve to fifteen enlisted men, while four or five officers in addition to the commander of the ship will be on board on all flights.

One feature of the ship is the photographic department, provision being made not only for the usual taking of aerial pictures but also for the development and printing of negatives while in flight. A complete photographic dark room is being fitted up in a roomy compartment directly under the passenger cabin.

Another interesting and practicable feature is the powerful radio equipment which is being installed which will enable persons on board to converse with ease with other aircraft or land stations many miles removed from the mighty ship of the air.

Fraud in Aerial Race Charged by Prize Donor

Omaha.—Charging fraud in the award in an air trophy race for commercial planes of which he was the donor, John Larsen of New York on Nov. 8 obtained a district court temporary injunction restraining the contest committee from paying, or E. F. White, of Fairhope, Ala., the winner, from receiving, $3,000 offered as first prize.

Load carried, speed and gasoline consumed were factors entering into results of the contest. Mr. Larsen's petition for injunction alleged that the contest committee failed to take into consideration a two-gallon emergency gravity gas tank on the wings of the winning plane, which is owned by C. B. Wrightsman of Tulsa, Okla. Had it been considered, he contended, Max Goodnough, of New York, piloting a Larsen plane, and second by the committee's award, would have taken first place.

District Judge Goss set the hearing for November 12.

High Intensity Beacon Erected at Staten Island

The Sperry Gyroscope Company high intensity vertical beacon at Tompkinsville, Staten Island, about 100 feet in from the shore and 1,000 feet eastwardly from the great Municipal Ferry Docks connecting with South Ferry, Manhattan, is now ready. The light will be vertical over this spot, gradually waving between ten and fifteen degrees each side of the vertical, making four beats a minute. The Lighthouse Commission is issuing a circular requesting observation on this beacon. Pilots of the U. S. Air Service are requested to make observation at the first opportunity and report to the Chief of Air Service as to the observation possible under the various weather conditions existing over Staten Island.

Photographing the White Mountains

One of the latest experiments conducted by the Air Service Engineering Division at McCook Field, Dayton, Ohio, is the photographic work being done with a view of presenting on a map the topography of the country photographed. The experiment was conducted in the White Mountains, and included an area 500 miles square. Information thus obtained is to be used by the U. S. Forestry Service. The expedition from McCook Field was in charge of Captain A. W. Stevens, and the equipment included a special DH4 plane equipped for photographic work, with two topographical cameras designed especially for mapping, and two Fairchild aerial cameras. The experiments occupied a period of six weeks, and practically all pictures were made at an altitude of 18,000 feet.

Sues Aviators for House Damage

Omaha.—Suit was filed here Nov. 7 against John Larsen, aeroplane manufacturer, and Col. H. E. Hartney, Washington, D. C., pilot and executive secretary of the Aero Club of America, for $2,639 damages, alleged to have resulted to the house of Charles Jesnen, Omaha, on August 3, 1920, when a plane they were flying crashed into the house.

This in one of the first cases of its kind in the courts, and the progress of the suit will be watched with interest.

Colonel R. Moizo of the Italian Delegation

Colonel Riccardo Moizo, one of the attachés to the Disarmament Conference, is one of the first Italian pilots, having obtained his license in the year 1911. He was also one of the first aviators to experiment the effectiveness of aviation in war, having taken active part in the occupation of Tripoli, and to all the campaigns of war in Libia with a squadron of Bleriot and Farman planes.

During some months of the world's war he commanded the Italian mobilized aviation forces at the front. He was seriously wounded during the passage of the Piave in the last action of Vittorio Veneto. Col. Moizo is now in command of the Training Group of the Italian Army Air Service.

Scott Field Note

The following information has been received from the Chief of the Bureau of Aeronautics, Navy Department:

Aviation activities have been discontinued at Yorktown, Va. This field will now be available only as an emergency landing field.

Gasoline, spare parts, etc., will *not* be available.

Aerial Lifeboat

A lifeboat for the air is a new contrivance being perfected in London for safety of passengers flying over water. It is an evolution of the parachute, by means of which the passengers can be released from a flying craft and dropped gracefully.

The device is so arranged that a pilot, when convinced that the chances of saving the lives of his passengers are extreme remote, simply pulls a lever, which releases the passenger compartment from the falling flying machine. The whole operation requires only four seconds. Tests have already proved satisfactory.

Aviators' Banquet

The need of better aerial preparedness was the keynote struck at the third annual aviators' dinner given Nov. 11th under the auspices of the Aero Club of America at the Commodore. More than five hundred military, naval and civilian pilots and many manufacturers were present. Among those at the speakers' table were Benedict Crowell, former Assistant Secretary of War; Eddie Rickenbacker, America's foremost ace, and Brigadier General William E. Mitchell, assistant chief of army aviation. The toastmaster was Rear Admiral W. F. Fullam, of the Naval War College.

"Aviation will be the dominating force in future war," the Admiral declared. "The overwhelming evidence of recent events forces us to conclude that sea power will hereafter be dependent upon air power. It must be perfectly evident that the transportation of large bodies of troops overseas in defenseless transports will be absolutely impossible if the enemy is supplied with an adequate air force. It simply cannot be done, no matter how powerful the accompanying force of destroyers may be.

"The danger to the fleet from aeroplane bombing has been discounted by naval officers until recently. But now we know that the most dangerous enemy of the enormous $20,000,000 vessels which now constitute the fighting line of the navy will soon be the aeroplane. By using bombs, torpedos, mines and poison gas, heavier-than-air machines can subject a fleet to conditions under which ships cannot exist."

General Mitchell took up the value of the aeroplane from the military point of view, declaring that the War Department had figures on just how much explosive and gas would be needed to destroy New York.

"Those figures show that a single squadron of twenty-five planes could wipe out the city in five minutes," he asserted. "After that what would be left of the United States? Her whole economic system would be crippled.

"Furthermore, for the cost of one destroyer, $2,500,000, we could build enough planes to wipe out any hostile fleet that could possibly be sent against us."

In order to bring American aviation up to the proper standard General Mitchell urged the unification of the War and Navy departments, with three bureaus, one for military, one for naval and one for aeronautical affairs.

Eddie Rickenbacker presented the need of keeping the air force personnel ready for an emergency. F. H. La Guardia, President of the Board of Aldermen, spoke of the possibility of going back to Congress to support aviation bills.

The AIRCRAFT TRADE REVIEW

Europe's Air Lines Fast Increasing

Washington.—Commercial aviation is rapidly forging to the front in Europe as the chief method of fast passenger and light freight traffic. Reports to the Department of Commerce show that the number of passengers and the quantity of exports and imports transported by aeroplane are increasing by leaps and bounds, especially between England and the Continent.

The average monthly value of British imports by aircraft from October, 1920, to April, 1921, amounted to about £50,000 (normally about $250,000). Exports averaged an equivalent of $140,000. Re-export values were about $135,000 a month.

Rates on parcel post shipments by aeroplane from London to Paris were reduced in August to 6 cents a pound, and parcels will be delivered to the house addressee upon payment of a small extra charge. Thus parcels are delivered in Paris on the day they are mailed in London. Nearly 200,000 letters were carried in the last nineteen months.

The London-Paris freight charge is 1 shilling a pound for packages up to 100 pounds and 10 pence a pound for packages weighing over 100 pounds.

A passenger aeroplane service has just been put in operation between Riga and Reval. Fokker monoplanes with accommodation for four passengers are used. The planes leave twice a week and connect with the aeroplane service from Riga to Danzig and from Danzig to Berlin. The trip from Reval to Riga is made in two hours and the fare is 6,000 marks, or about $15 at the present rate of exchange.

There are in Europe now twenty air lines, covering a total distance of 6,000 miles. France holds first place with lines covering 2,900 miles. Germany is second with 2,000 miles and England is third. There are many local lines also, Italy leading with 1,260 miles.

The French are anxious to establish a line between Paris and Constantinople and one between Paris and Toulouse, the latter to form part of an international line 1,800 miles long.

New London Seaplane Station

The following information has been received from the president of the Aero Transportation Company of New London, Connecticut:

The Thames River at the city of New London affords good facilities for seaplanes. The locality may be recognized by the two large parallel steel bridges extending across the river from New London on the western bank to Groton on the eastern bank. The river is large enough to allow of take-off in any direction. There is a tidal range of about 4 feet with plenty of depth. The eastern bank of the river consists mostly of ledge rock; the western bank is sand with excellent beaches for landing and for repairs.

Gasoline, oils, supplies, and moorings can be found in Greens Harbor, on the western bank of the river below New London, southward of an old stone fortification, northward of a large marine wrecking company's yard and westward of an island piled up with driftwood. There is a gasoline pump at the end of the dock and excellent beaches and reasonable service can be had here.

Facilities for hauling out can be had at the Ship & Engine Co.'s plant on the eastern side of the river. Repairs to hulls of boats can be made by the Sea Sled Company, of Mystic, or by the Aero Transportation Company of New London. The latter company keeps Liberty Motor parts and does general motor and plane repairs.

Subsidies for Aviation By European Governments

France and Belgium grant varying sums towards payment of pilots, cost of gas and oil, etc. Germany gives a premium on the number of kilometers flown. England pays a subsidy which, for 1922, is placed at £200,000, which subsidy, it is stated, is for services from London to Paris, to Brussels and also to Amsterdam, the British competing with a Dutch company for the service between Amsterdam and London.

Speedy Monoplanes

The Nieuport Monoplane was a plane to conjure with in the early days, and its reputation for speed has outlived that of many of its pioneer rivals. The latest model (Nieuport-Delage) just put up a new record, being flown at 206 miles per hour with a 300 h.p. Hispano-Suiza motor. This new model must, however, still be called a biplane, but the lower plane is so small as to be quite insignificant. It consists of a very reduced surface, one metre square, affixed between the two landing wheels. The upper plane has a span of 8 metres and a breadth of 1 metre and 50 c., the fuselage measures 6 metres, 50 c., and the whole machine when ready for flight weighs 950 kilogrammes.

The latest type of monoplane in England, the Handalula, is a radical departure from current practice, the wing being shaped like that of a bird. This machine, which is now simply called "Alula," was flown by Commander Kenworthy at Northolt Airdrome and attained a speed of 187 miles an hour. It reached a height of 3,000 feet on almost its first flight. This remarkable performance was carried out with only a 300 h.p. Hispano-Suiza engine, but with a larger machine of modified design and engined by a 1,000 h.p. Napier "Cub," a much greater rate of speed is expected. The Alula wing is a specially high lift wing, said to be very efficient and designed by Mr. Holle, who has been studying bird flight and the subject of high lift wings for 20 years. A London paper, touching on the remarkable speed performances of the above planes, states: "Now that the problem of using larger engines in monoplanes is well nigh solved by mounting them in a fuselage below the wings instead of on top, we may expect that the speed and climbing records will fall like a shower of stars for a while, after which there will be a pause to consider how the designs can be transformed into a little more aeroplane and less engine."

Reliability of Aero Engines

The London *Financial News*, commenting upon the astounding mileage achieved by aeroplanes making daily flights between London and Paris, states that the most successful machines operating between these two cities have been the DH-18's which, fitted with a single 450 h.p. Napier aero engine, have a passenger carrying capacity of eight and a total loading capacity of 18,000 lbs. These Napier engines run the remarkable distance of 10,000 miles before they are taken down for examination, not because it is necessary but purely as a precautionary measure as a careful car owner will have his engine taken down after a similar mileage. After examination these engines are reassembled and put into service again. Some of the Napier engines on the London to Paris aero mail have actually covered a distance of 25,000 miles and are still making the daily journey.

Camp Dix Landing Facilities

The following information concerning Camp Dix has been received from Captain F. P. Mulcahy, U. S. M. C., under date of October 19, 1921:

Camp Dix is located about three-fourths mile south of the small town of Wrightstown, in Burlington County, N. J. The landing field is eastward of Camp Dix and southeastward of the hospital and the power plant, which has six very tall smokestacks. The landing field is 300 feet above sea level; 1,500 feet by 300 feet, long axis east and west; prevailing wind, west. The field is smooth; a few dead furrows run lengthwise but do not bother a plane in landing. The field is also fair under various weather conditions. There is a low fence at the eastern end of the field; the west is open and clear but very narrow. There are trees along the whole north side, while the south side is open, but landings must be made not more than 100 yards from the north edge, as a road extends across the middle of the field, north to south, and a ditch parallels this road southward from a point 100 yards from the north edge. The field can be approached from the south, but approach from the east or west is preferable.

There are no repair shops, but gasoline, oil, and fresh water are available. There are no aviation supplies. The field is available for use by anyone.

Loening to Build New Factory

Albert B. Ashforth, Inc., leased for the estate of H. D. Brookman a plot, 129.9x 98.9, on the south side of Thirty-first Street, 225 feet east of First Avenue, to the Loening Aeronautical Corporation, manufacturers of the Loening flying boat. They have contracted for the erection of a building especially designed for the manufacture of flying boats and aeroplanes.

THE ORENCO TYPE F-4 FIVE-PLACE TOURISTER

THE type F-4 is the second of the commercial types developed by the Ordnance Engineering Corporation. Data gained from the F type produced last year, and which proved so successful as a passenger carrier, made possible an improved model embodying features which overcome the doubts of the most particular. For example, there is the side door to the front cockpit where three passengers can be accommodated. Easy access has thus been achieved with no diminishing of the structural safety, for a neat quick-locking catch on the door unites the longerons and their strength is unimpaired.

Mahogany veneer sides and bottom, triple sets of longerons and diagonal spruce bracing form the body and give it rigidity as well as fineness of contour. The finish reminds one of the Orenco type D military pursuit fighter, one of the most successful of single seaters and most attractive in appearance.

Dual controls in the rear cockpit enable a pilot to allow his passenger to handle the plane at safe altitudes. As the pilot can observe the way in which the controls are handled he can quickly correct improper manœuvres by an inexperienced passenger. This seating arrangement has proven to be the best for professional instruction, as the pupil and instructor can make themselves understood easily. The closeness of the pilot also gives a pupil confidence, one of the essential attributes of a successful air pupil.

The front cockpit is roomy and comfortable. There are no controls there. A locker is provided for light baggage. As the illustrations show, there are no incidence cables to obstruct the cockpit. Vision forward and downward are excellent.

Principal dimensions and specifications are as follows:

Dimensions

Span, both wings	39 ft. 0 in.
Chord	5 ft. 0 in.
Gap	5 ft. 3 in.
Stagger	14.5 in.
Length overall	21 ft. 10 in.
Height overall (at center section)	9 ft. 4 in.
Distance from ground to c. l. of propeller	5 ft. 3 in
Clearance between propeller and ground	11 in.
Propeller diameter	8 ft. 8 in.

Areas

	Square feet
Main planes (4) each 76 sq. ft.	304
Center section	14.4
Ailerons (4) each 10 sq. ft.	40
Total supporting area	358.4
F in 4.7, Rudder 11.8	16.5
Elevators 23.1, Stabilizer 27.7	50.8

Weights

	Pounds
Total weight with full load	2,825
Total useful load	978
Net weight	1 847
Weight per horsepower	15.7
Weight per square foot of surface	7.3

Performance

Maximum speed at ground	110 m.p.h.
Cruising speed	99 m.p.h.
Landing speed	49 m.p.h.
Duration of flight, 5 people (cruising speed)	2.4 hours
Duration of flight, 4 people (cruising speed)	4.2 hours
Duration of flight (3 people (cruising speed)	6 hours
Climb to 10,000 ft., full load	23 minutes

Main Planes

The R. A. F. No. 15 wing curve is used. Both wings are set at an incidence of 2 degrees.

Ribs in the slip stream are spaced 9 inches apart; beyond this the spacing is 12 inches. Internal struts and wires are used for drift bracing.

The center section contains a gravity tank which holds 32 gallons of gasoline. Center section 44 3/16″ wide.

Fuselage

Veneer of 3/32″ three-ply mahogany covers the sides of the body from the radiator to the rear of the pilots' cockpit. Veneer on bottom from front landing strut to rear of cockpit. Veneer sides and bottom below the stabilizer.

The maximum width of body, at front cockpit, is 44 3/16″ outside. This provides ample room for three occupants.

Three longerons are used on each side. The top longeron is hinged at the left of the front cockpit and a veneer door swings outward. A streamline knob at the top locks the door, and being capped with channel steel, the longeron is as strong as though continuous.

Empennage

A high aspect ratio stabilizer is used, shown by experience to be desirable. The elevators are balanced so as to relieve the pilot of strain. The stabilizer is adjustable within small limits, though no alteration was found necessary by the test flights.

The fin and rudder are conventional and quite effectvie. One pair of cables from the pilots' foot-bar operates the rudder. The two rudder bars in the cockpit are interconnected by levers and a horizontal bar in front of the rudder bar.

Landing Gear

Wheels and axle are of the De H. type; their ruggedness makes them ideal for cross-country trips, and in case of breakage they are readily replaced at most flying fields. The chassis V's are of laminated spruce.

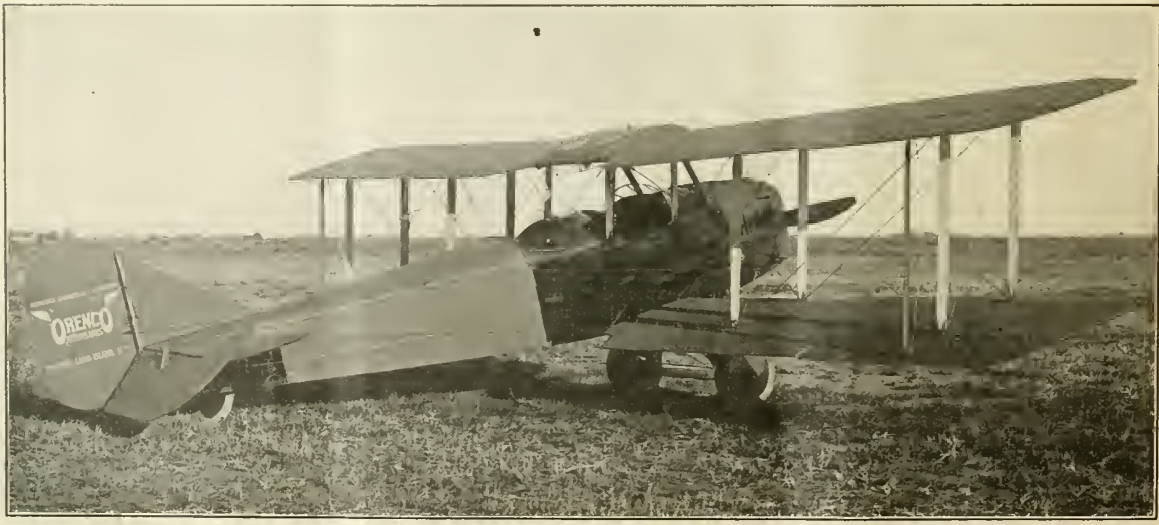
The tail skid is of special "Orenco" design, developed from previously tested types.

Engine Group

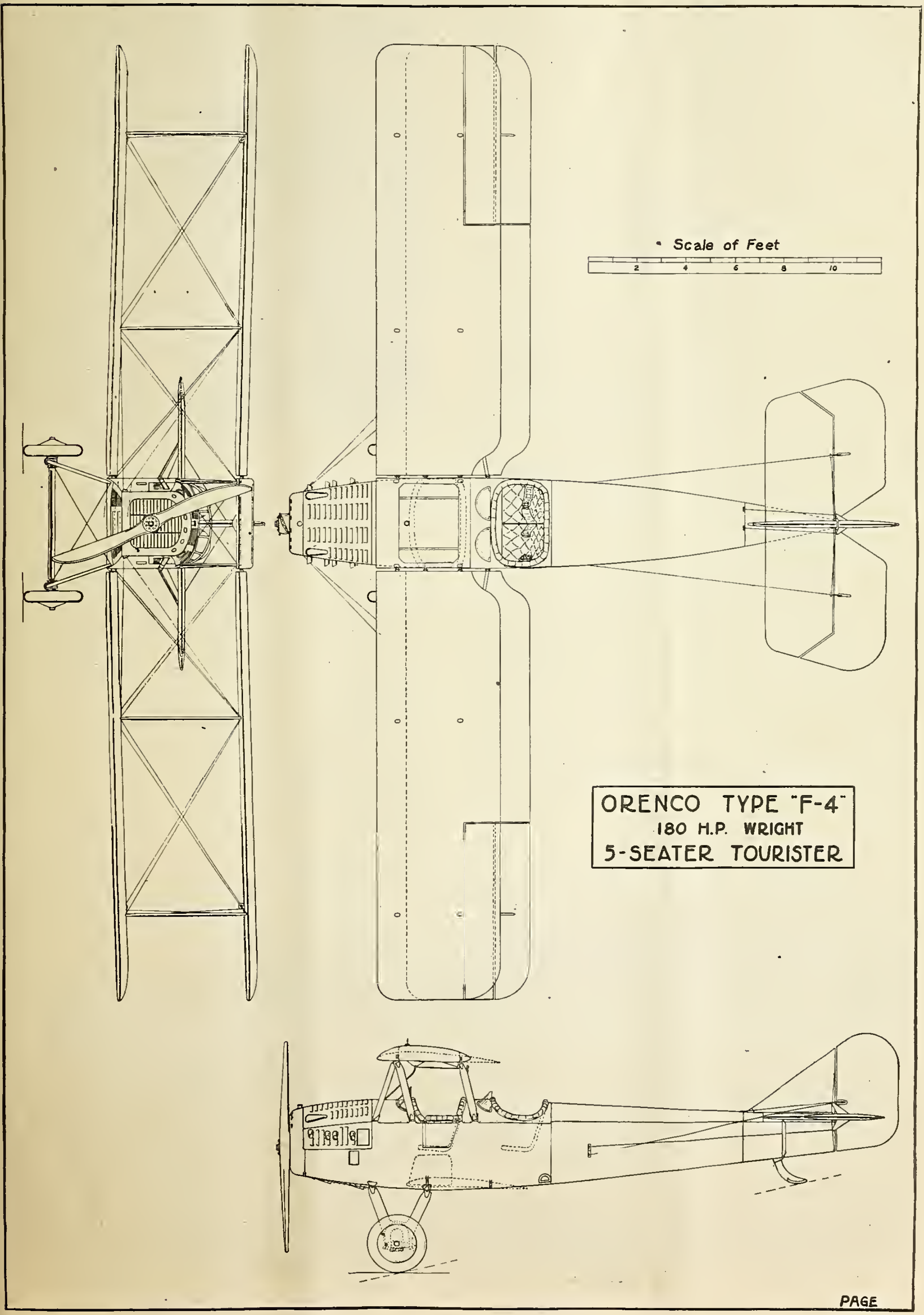
The latest model Wright E-2 engine is used. This new engine develops 200 h.p. at 1800 r.p.m., and 220 h.p. at 2000 r.p.m., but its average number of revolutions in the F-4 is 1600, at which rate the power is 180 h.p. The engine weighs 485 lbs. dry with hub. Gasoline consumed per h.p. hour, .48 lbs.

The propeller was especially designed for the F-4 by the Hartzell Walnut Propeller Co. It is unusually efficient and gives a maximum of thrust for the power available. In combination with the Wright engine, the power unit is considered the most reliable known for this purpose.

A hand-starting magneto facilitates starting. A hand-primer



The Orenco Type F-4 Tourister



ORENCO TYPE "F-4"
180 H.P. WRIGHT
5-SEATER TOURISTER

is located on the instrument board. Sperry instruments are used. The instrument board includes the following: Turn-indicator, tachometer, air and oil pressure gauges, air speed meter, altimeter, moto-meter, clock and compass. The engine throttle is in the center of the dashboard, where it can be operated from either right or left rear seats. A hand pump below the seat is easily reached.

The main fuel tank, holding 48 gallons, is directly below the front seat. From this tank the fuel is pumped (by the engine or by hand pump) to the large gravity tank in the center section. From the gravity tank the gas flows to the carburetor in a direct line so as to minimize the risk of obstructions in the line. A float-type capacity gage shows the pilot the amount of fuel in the gravity tank. A shut-off valve under this tank has an extension handle within the pilot's reach.

The radiator is made of standard hexagon copper tubes 4" long. Area of radiator surface, 176 square feet. Frontal area of radiator, 668 square inches. Shutters, controlled from the pilot's cockpit, are put into operation to reduce the cooling effect at altitudes and ordinary cold weather temperatures.

THE SCOPE OF WIND TUNNEL RESEARCH

With a Special Word to the Technical Schools

By E. N. FALES and F. W. CALDWELL

PART I

Extenson of Aeronautical Research: In the development of areonautics to date, there is an element,—the Wind Tunnel,—which has proved itself essential, and to which we are now according, in the United States, a gratifying though tardy recognition. It is a fact that those nations who have attained leadership in aeronautics are the ones who have best exploited the aerodynamic laboratory. Thus, if we survey the past eighteen years, we see that the United States invented the aeroplane, aided by the Wind Tunnel of the Wright Brothers. France soon took the lead in early development,—and it was there the first large commercial tunnel was established by Eiffel. England then captured France's lead; her Government established several wind tunnels, appointed competent personnel to handle scientific research, and deliberately built up her technical sub-structure until in the world war she obtained air supremacy both in a military and scientific sense.

As for Germany, it transpires that all her aeronautic achievement at the fighting front had its scientific counterpart behind the lines, where the Junkers Wind Tunnel, the Zeppelin Wind Tunnel, Dr. Prandtl's Wind Tunnel, etc., produced the noteworthy results which are now common knowledge. Italy has done little wind tunnel work and we hear correspondingly little of Italian progress. The United States has but a few wind tunnels,—far less than Europe,—with the result that, deficient in research facilities, we have to import our design data from Great Britain, France, and Germany.

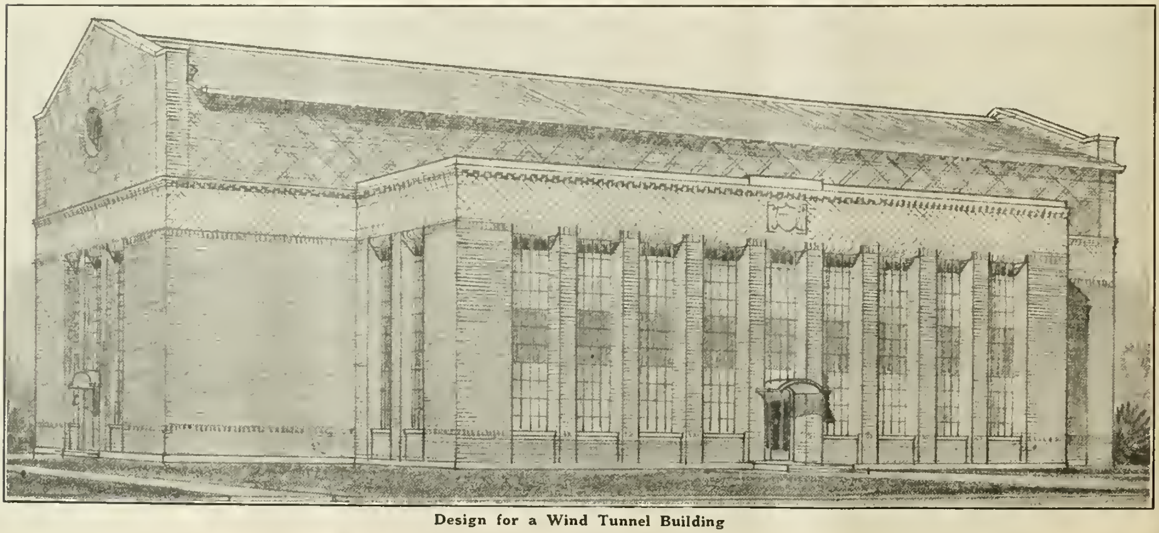
In order to remedy the situation educational development is needed, such as must come in the colleges. It is the purpose of this article to emphasize the coming expansion of aerodynamic knowledge, which is reaching a growth more and more attractive to laboratory investigation. Since this knowledge is extending its influence not only in the realm of manflight, but also in the older branches of engineering like ventilation and surveying, it ought preeminently to be subsidized by the technical schools.

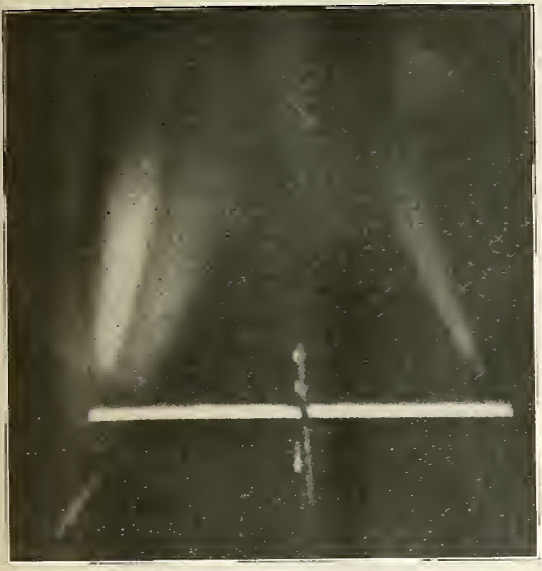
In presenting this viewpoint to the college authorities, it is desirable to summarize yet again the imminent importance of aeronautics. For, even after the development of recent years we are confronted with skepticism, which dies hard, and which it is the business of the colleges to illumine. Of course thoughtful persons acknowledge that this science will in time play an important part in the daily affairs of humanity; but they hesitate to conclude that manflight will become a factor to the present generation. For this they cannot be blamed,—even in aeronautical circles the calling is viewed as offering an uncertain livelihood. But while the Aeronautical Engineer comprehends intimately the hazardous side, he senses with equal intimacy the future importance of the field in which he is a pioneer. The colleges, as educators, are responsible to the future generations, and careful scrutiny of the swift progress already made will result in an optimistic appraisement.

Imminent Importance of Aeronautics: Compare the art in 1914 with the art today,—and observe that whereas in 1914 there was a small precarious aeronautical business, there is today more than tenfold the capital involved; whereas in 1914 the number of craft in daily flight was a matter of dozens, today it is hundreds; whereas in 1914 the personnel engaged was a matter of dozens, today it is thousands; whereas in 1914 there were two wind tunnels in the United States, today these are multiplied sevenfold. Whereas, in 1914, there were but a few Universities concerned over their duties to aeronautics, today there are dozens.

The more conservative organizations, which in 1914 did not care to notice aeronautics, today are courting her open-armed. The A. S. M. E. has established an aeronautical section; the S. A. E. has given one-half of its scope to aeronautics, and altered its name to suit; municipalities are setting aside landing fields, establishing air boards, air police, and vying with one another for first place as air ports.

We see the air mail firmly established as a daily routine; the forest fire-patrol service greatly simplified by air craft; the


Design for a Wind Tunnel Building



Air flow as visualized in Wind Tunnel

Navy with its dreadnoughts threatened by the new swift destroyer of the air; the U. S. Geological Survey provided, through aerial photography, with an important aid to their map-making. We see air passenger routes profitably operating; and landing fields established throughout the country.

The Wind Tunnel the Starting Point of Technical Aeronautics: What part has the Wind Tunnel played in this development? The answer is a category full of detail. The Wind Tunnel enabled the Wrights to perfect their original aeroplane and to predict its performance before it flew. It enabled Nieuport to design the first high speed aeroplane which subsequently won the Gordon-Bennett Cup Race, furnishing him the necessary data in the Champ de Mars Laboratory even prior to flight test. It enabled Junkers to develop his thick wing aeroplane. It enabled the British to inaugurate a new era of aeroplane stability. It may be thanked for the new high lift wings, for without it Handley Page, Jacobs, and others could not have developed these interesting improvements.

It has enabled aircraft designers to obtain advance data on proposed novel designs, so that for two per cent of the estimated cost, success or failure is predicted. (The figure 2% represents the cost of scale model and laboratory tests, as a fraction of total cost of full size machine.) Where the wind tunnel has been unavailable, cases are on record in which large sums of money were therefore wasted,—sufficient in amount to buy up every wind tunnel in the country. For the well planned wind tunnel test is equivalent to the civil engineer's "preliminary survey"; upon it he bases all his future work. It has been the "watchdog of efficiency" during ten years of innumerable routine studies on models of wings, complete aeroplanes, radiators, air bombs, dirigibles, instruments, etc., during which time our fund of aeronautical knowledge has vastly increased and our methods of aeronautical research improved. Indeed in the Wind Tunnel, the intricate motion of the air itself has been made visible, so that for the first time in the history of mankind can the "way of the winds" be observed with the naked eye.

Research Work Necessary in Every Industry Today: It is seen from this category of accomplishments that aeronautics has in the wind tunnel just such a research laboratory as is essential to the electrical, chemical, etc., industries, and we can better appreciate the part it has to play if we look at it in this light. We hear a good deal nowadays on the subject of the research department. It is a product of the past few decades, when industrial organizations have found that they cannot by any other means keep pace with rapidly improving technical processes. While the factory and the sales office have been the two main departments of the typical American industrial organization, the changing times find them unable to handle their business without a further new department;—the Research Department.

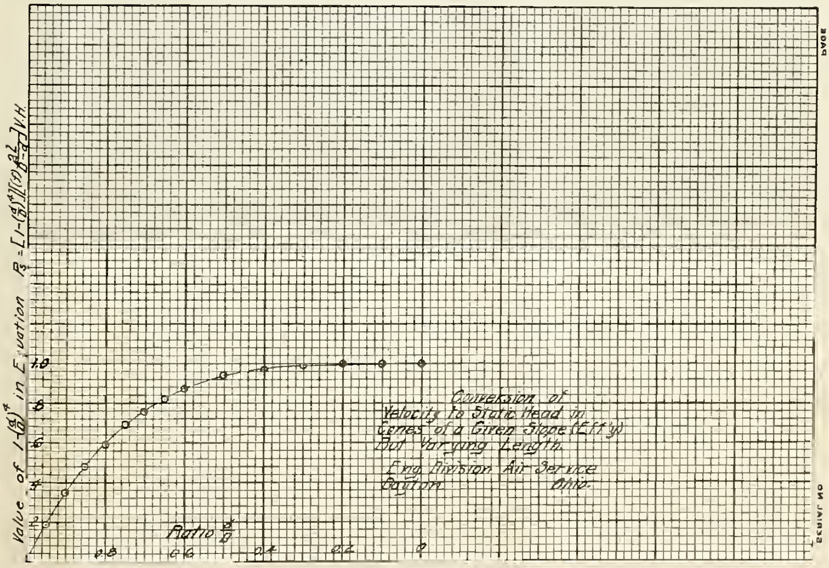
For example, in the electrical field, which really is only thirty years old, the range of practical application has extended further than the pioneers could predict. The salesman does not dare say what kind of lamp, or what kind of motor, or battery he will be selling next year. Nor does a factory manager dare say a year in advance that some new invention will not require retooling sufficient to establish in effect a new factory.

We are at the present time witnessing the incompetence of the factory and sales organizations to keep abreast of the advancing art; and we see as a result the great electrical organizations establishing research departments. Here competent scientists or engineers are expected to steep themselves in the principles concerned in the commerical novelties which each year appear. Thus the Westinghouse Electric, General Electric, Delco, etc., have research laboratories whose atmosphere is different from that of their main organization, being more like a university; the experimenters have free reign to test out a thousand and one propositions for the sake of the few which may in the future develop importance.

In other lines besides electricity we have, for instance, the Underwriter's Laboratory, which is equipped for many kinds of first hand testing. We have also the research department of the General Motors Corporation, whose engineers will be found experimenting with novel features of automobiles built either by themselves or some other experimenter here or abroad.

Research an Insurance for the Welfare of Industry: It must not be inferred that the establishment of a research department is a speculation, whose results are problematical. It is really, under proper management, a sound investment, or better, a sort of insurance policy taken out on the future welfare of the business. In a nutshell the above resolves itself into this:—that a research department is a device for keeping an industrial organization up-to-date. It is not suited to a conservative, nonprogressive industry. In an industry which is full of zest there will be a demand in the various departments for the latest information touching what has been done in other plants and in other countries to solve particular problems. The Research Department will be expected to turn out concise and pertinent information on a large variety of general and detailed problems as they arise; it must therefore embrace a fund of general technical information. Kept up-to-date by organized reading, as well as by organized experiments, it must indeed be a veritable encyclopedia of experimental knowledge.

It is from considerations such as these that the aeronautical industry has come to recognize the wind tunnel as essential.



Wind Tunnel Regenerative Cone Chart

When we see that large numbers of aeroplane companies have established wind tunnels, we at once assume that there is some commercial advantage to be derived, (in Germany the Junkers, etc., and in England the R. A. F., Handley Page, etc., and in America, the Curtiss, Wright, Boeing Companies.) Since the wind tunnel is no a source of revenue, its benefits do not appear in terms of cash; but they frequently exceed the cost a hundred fold. This was recognized years ago by Eiffel, when he built his French wind tunnel in 1910 (?).

Eiffel, by the way, is a practical civil engineer, as attested by his work on the old original Panama Canal, and the Eiffel Tower. As a practical engineer he realized that his best contribution to the art of aeronautics could be made by establishing a wind tunnel. This he did and his reports are now classics in daily use by every designer of aeroplanes.

It is a significant fact that the Curtiss Company, at Long Island, found its small four-foot wind tunnel inadequate and now operates two complete and separate wind tunnels. These have been a source of revenue to the Company due to tests made for the Government.

The Navy Department under Admiral Taylor, early recognized the benefits of a wind tunnel and built one; it is significant that they have enlarged their laboratory until it now comprises two complete wind tunnels.

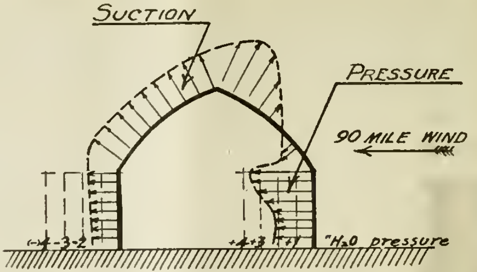
It is further significant of the usefulness of wind tunnels that Boston Tech, which had the first accurate wind tunnel in the country, is planning an additional larger one. Although their small wind tunnel has constituted a standard for the United States, they feel that they cannot keep abreast with aeronautical progress without a second and larger wind tunnel. It may be said that the small wind tunnel at Boston Tech has been in continued demand by individuals, commercial organizations, and by the Government; the latter at present continues a contract of several years standing for the testing of various experimental models in the wind tunnel.

The Opportunity of the Universities: There are a gratifying number of Universities preparing to take up aeronautical instruction today, more than ever before. They consider—and rightly—that they must have a wind tunnel laboratory for this instruction. Aerodynamics with its paradoxes and new conceptions to puzzle the student, is only half taught if no laboratory research is included. Neither teacher nor student can keep up to date without it. It is as essential to an aeronautical course as the Electrical Laboratory to an Electrical Course, or the Physics Laboratory to a Physics Course; without it the instruction loses its verve.

First Cost Need Not Be Great: A wind tunnel may be large or small, expensive or inexpensive as the builder desires; and need not be omitted from an aeronautics course on the grounds of expense. The first significant wind tunnel, that of the Wright Brothers,—was built by them at a time when their funds were small. The Mass. Institute of Technology four-foot tunnel cost only about $10,000.00, building and all. In Germany the wind tunnel is so well established as an adjunct to aeronautical courses that miniature plants for lecture room use may be bought for one hundred marks. Given a motor, balance, and available housing space, such a plant may be largely a matter of carpentry. Thanks to the regenerative cone principle, the power required may be several times less than the energy of the air current. Of course a large plant may cost a hundred thousand dollars, but for University use a small investment can be made the starting point of very useful work.

Wind Tunnel the Precursor to Knowledge of Fluid Dynamics: The wind tunnel, once established in a university for the purpose of aeronautical instruction, opens in addition a wide field for scientific research. The fundamental laws of fluid dynamics are still in the elementary rational stage, and require the sort of empirical research which we associate with colleges, and which will surely appertain in the future to them. Even if we imagine all practical and commercial value in aeronautics to disappear, there still will remain the realm of academic research for knowledge wherein the wind tunnel will continue to hold its place.

There are many applications of wind tunnel work outside the confinements of mechanical flight. The Government wind tunnel sections receive inquiries of diverse natures from blower concerns, ventilation engineers, fan manufacturers, windmill designers, designers of wind-bracing, etc.,— in fact from all the older branches of engineering wherein the phenomena of fluid dynamics play a part. Examples of wind tunnel tests dealing with these older branches of engineering are:—tests on wind resistance of roofs, and buildings; on windage of battleships; on the heat conduction of radiators due to air flow; on the calibration of air flow meters; on the action of ventilating apparatus; on the design of blowers and fans; on the nature of the meteorological movements of the wind; on the nature of the flow of gases in pipes; on the question of noise propagation in the air by ventilation apparatus.



CIVIL ENGINEERING PROBLEM FOR WIND TUNNEL STUDY ~ Roof and Wall Pressures due to Wind on Model of Large Building ~ (Sketch from Eiffel's "Nouvelles Recherches")

All the wind tunnels operating in the United States bear testimony to the variegated tests which are thus suggested. This is only natural, when we consider how large a part air flow plays in commercial life, and how little has been learned regarding it, prior to the advent of aeronautics. Except for the wind tunnel there is no way to find out precisely what the air does in any given application. Suppose, for example, a blower manufacturer suspects he can improve the efficiency of his product, perhaps by changing the shape of the impeller vanes. In the past, he availed himself of the cut-and-try method, making up one after another full sized impeller wheels until satisfactory results were obtained. Today, he may go to the wind tunnel, secure tests on small models of isolated blades, and from the coefficients thus determined, he can design his machine with full assurance of success. Wind tunnel coefficients have been found to apply with great success to the case of rotary blowers.

There is the whole field of the dynamics of meteorology; with its bearing on weather prediction. Our knowledge of air circulation has already been improved through exploration of the higher levels by air pilots; there is much to study in the laboratory;—the shape, size, position, etc., of the phenomena associated can be observed, to small scale, best in the wind tunnel. It is here that the vortex motion predicted by mathematicians has first been made visible; in such an experiment the observer sees before his eyes a working model of the tornado, or wind gust, or a cloud formation, or of the vortex sheets separating the various air layers of the atmosphere.

There is a close connection between meteorology and aerodynamics. Theory analyzes them both on a rational basis; and until now has been our nearest approach to knowledge. Theory is incomplete as applied to the terrestrial winds, but will gain precision from association with study of the laws of man-flight. These laws, though remarkable, have hardly been available to the practical engineer, being in the past, unsupported by experiment.

It is this sort of empirical experience which is at last possible, thanks to the wind tunnel. Just so far as the theory is armed with empirical constants and coefficients, so far can we predict an actual design. And we are beginning to coordinate theory with practice; a noteworthy step toward this end having been accomplished by Prandtl, in his wind tunnel at Gottingen (Germany). By means of his experiments made there and his aerofoil theory, we can, to a certain extent, calculate a result, where formerly we had to test.

It is but a beginning. The whole field of fluid dynamics with its unexploited treasures of knowledge, remains to be explored; invisible and mysterious except as exposed in the wind tunnel, it must become in due time a new branch of science, touching our daily life in a hundred ways. We must avail ourselves of new instruments for this research; and none is superior to the wind tunnel. We should have many wind tunnels, for this means many investigators. We shall be justified in duplicating apparatus if thereby we bring to the work a plurality of intellects. For human intellects do not appear in duplicate; we need to focus scientific thought of every nature on our aerodynamic problems; and to multiply this personnel is the province of colleges. Should every state in the Union and every technical school establish an aeronautical course, it would not be too many, so long as a progressive wind tunnel program were included.

(To be continued)

DETERMINATION OF THE BEST WING LOADING FOR SINGLE SEATER PURSUIT AEROPLANES

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Object

THE object of the investigation covered by this report was to determine the effect of changes in wing loadings and aspect ratio on the performance and weight of single seater pursuit aeroplanes. his information was obtained by making six preliminary wing designs for an aeroplane of this type using two aspect ratios and three wing loadings. It was intended to use three aspect ratios, but that was found unnecessary. Only rough preliminary designs were made, as it was believed that the results were as good for comparative purposes as if more refined designs had been used. The type of structure and the approximations used are given below.

Conclusions

1. The lighter the wing loading the better will be the performance of a single seater pursuit aeroplane in most particulars. The greatest advantages are in ceiling and rate of climb, while there is a slight advantage in high speed when near the ceiling. In the cases considered, the time of climb to 15,000 ft. was 35 per cent longer for the most highly loaded aeroplane than for the most lightly loaded one; and there was a difference of 2 600 ft. between the service ceiling of the same two aeroplanes.

2. Higher speed near the ground is obtained by using a heavy loading, but this advantage disappears at altitude. At the ground the maximum difference in speed is 7.5 miles per hour. At 15,000 ft. it is only 3.5 m.p.h. and above 20,000 ft. the lightly loaded aeroplane has the higher speed. Thus, at the altitudes at which the pursuit aeroplane is expected to work, the lightly loaded aeroplane can climb higher and more quickly and can go as fast as the heavily loaded aeroplane.

3. The only effect of a change in aspect ratio on the performance is through the change in efficiency of the wings. As this effect is small in the range investigated no allowance was made for it. The lower the aspect ratio, however, the lower will be the weight of the wing structure, as the spars will be both lighter per foot of length and shorter.

4. The change in performance due to a variation of 12 per cent in the weight of the wing structure is negligible.

5. The dead weight per square foot of the wings increases with an increase of either aspect ratio or wing loading. The maximum difference between the designs made for this report was only about 12 per cent of the total weight of the wings.

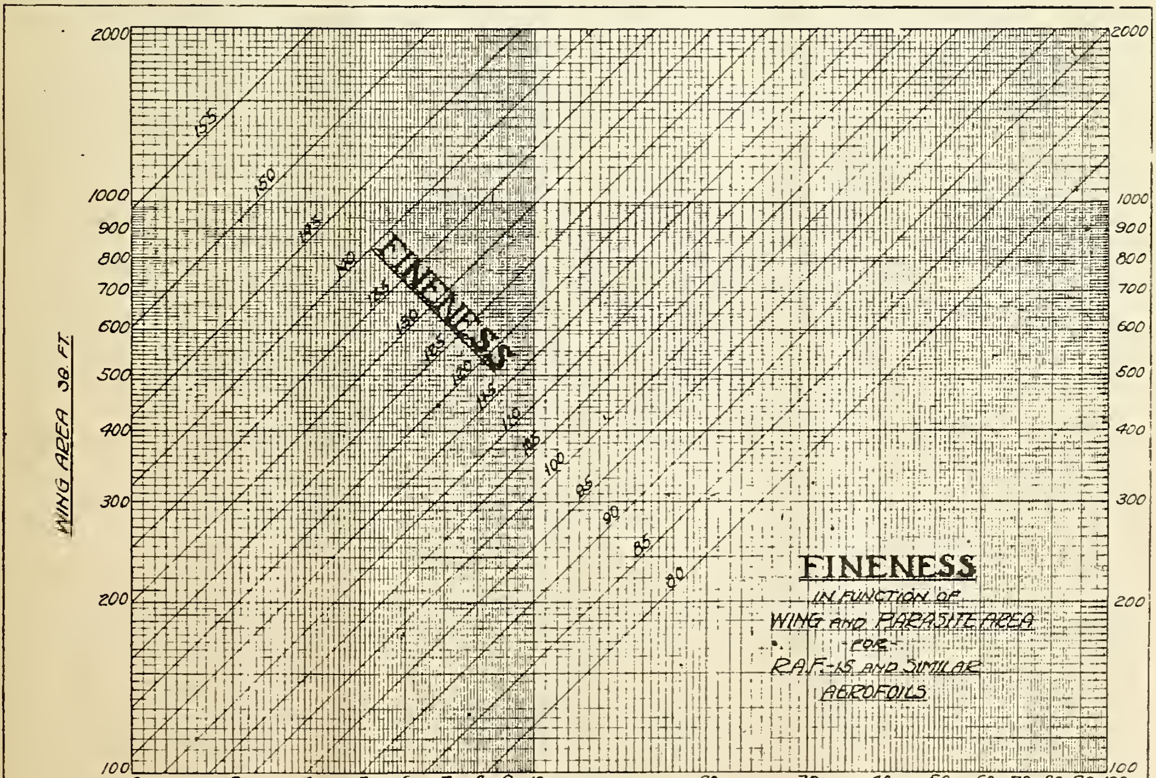
6. The lightest practicable wing loading should be used for single seater pursuit aeroplanes. Just what this loading should be in any particular case depends on considerations of vision, maneuverability, storage, etc., which cannot be compared quantitatively with performance. Therefore, the exact value used must be chosen by the judgment of the designer.

Method of Design

In order to reduce the labor of computation the simplest type of construction was assumed, and certain assumptions were made to simplify the work still further. As a result the spar and strut sizes selected would not be the correct sizes to use in an actual design, but as the same assumptions and approximations were used for all the designs, valid comparisons may be made from the data obtained. The designs were carried out following the methods outlined in "Stress Analysis and Design of Aeroplanes", except that drag forces were neglected and the design loads on the front and rear trusses were assumed to be 6.0W and 4.0W respectively, where W was the weight of the aeroplane minus wings. These values are slightly higher than would be obtained from the assumed spar locations and load factors and the center of pressure travel of the aerofoil used, but were used to simplify computations.

The following data were assumed in all designs:

Aerofoil section .... R.A.F. 15



Location of the front spar in per cent of chord	13
Location of the rear spar in per cent of chord	65
Stagger	None
Efficiency of lower wing	90 per cent
Gap-chord ratio	1.0

Spars hinged at center section
Wing tips square
Both wings of same span and chord
Front and rear struts alike
Upper and lower spars alike

After designing the spars and struts their weight per sq. ft. of wing area was computed. The remainder of the wing structure, including fabric, drag, trussing, etc., was assumed to have the same weight per sq.ft. of wing area for all designs. Assuming the lightest wing to weigh 1.00 lb. per sq. ft. the weights of the other wings were easily computed.

The wing loading was then revised and the power loading computed using 328 horsepower for each design. This is the normal horsepower of the Packard-1237 engine, which is a typical engine for the type of aeroplane considered. For computing the fineness an equivalent flat plate area of 5.0 sq. ft. was assumed to represent the structural resistance and the fineness obtained from the chart, Fig. 1.

Description of Chart

In a report entitled "Aeroplane Performance and Design Chart"* it was pointed out that "Fineness" depended on the parasite resistance and on the loading per sq. ft. of wing surface. Recent developments have shown that "Fineness" can be expressed as a function of Equivalent Flat Plate Area and of wing area and section. Fig. 1 gives this function graphically for R.A.F. 15 wing section. It was obtained in the following manner:

given $W = \delta K_y F V^2$ (1)

and $\eta \text{ H.P.} = (\delta K_x F V^3 + 0.64 \delta A_e V^3) / 550$ (2)

where F = wing area in sq. ft.
η = propeller efficiency
A_e = equivalent flat plate area of parasite resistance
δ = density = .00237
V = velocity in ft./sec.
K_x and K_y in absolute units

By the method of least squares, K_x can be expressed as a function of K_y

$$K_x = A + B K_y^2 \qquad (3)$$

Where A = .007 and B = .146 for R.A.F. 15.
Simultaneous solution of equations (1), (2) and (3) yields the following:

$$550 \eta \text{ H.P.} = \frac{\delta A W}{\phi} V^3 + \frac{B \phi W}{\delta V} + 0.64 \delta A_e V^3 \qquad (4)$$

$$\text{where} \quad \phi = \frac{W}{F} = \text{wing loading}$$

Substituting various values of H.P., W, ϕ and A_e, this equation was solved for V and "Fineness" then found from the "Aeroplane Performance and Design Chart." Fig. 1 is thus obtained and it will be noted that the relation can be expressed by one curve, "Fineness" = f (A_e/F). Thus it is seen that the smaller the parasite area for a given wing area, the greater the "Fineness" and hence performance. An extended discussion of this subject will appear later in a special report on "Fineness."

Computation of Performance Data

Knowing the wing loading, power loading, and fineness, the performances were obtained from the Aeroplane Performance Chart in McCook Field Report No. 1380.

Table I gives the essential data on the six designs on which this report is based, in regard to both structural weight and performance.

TABLE I.

Weight and Performance Data on Assumed Designs

ø	Case I	Case II	Case III	Case IV	Case V	Case VI
Aspect ratio	5.5	5.5	5.5	5.0	5.0	5.0
Wing loading (approx.)	7.12 lbs. sq. ft.	8.46	9.98	7.04	8.62	9.98
Chord	70 inches	63.5	58	74	66	61
Wing area	361 sq. ft.	295	245	365	289	245.5
Spar area (one wing)	10.03 sq. in.	9.96	9.97	8.68	8.76	8.57
Spar wt. per ft.	1.881 lbs.	1.868	1.869	1.628	1.643	1.607
Spar wt. per ft. ² of wing	0.322 lbs.	0.352	0.386	0.264	0.299	0.316
Area of 1 strut	5.53 sq. in.	5.04	4.56	5.72	5.09	4.71
Length of strut	66 inches	60	55	70	62	57.5
Wt. of 4 struts	22.8 lbs.	18.9	15.68	25.0	19.7	16.95
Wt. of struts per sq. ft. of wing	0.061 lbs. sq. ft.	0.064	0.064	0.068	0.068	0.069
Wt. of ribs, etc.	0.668 lbs. sq. ft.	0.668	0.668	0.668	0.668	0.668
Wt. of wings per sq. ft.	1.051 lbs. sq. ft.	1.084	1.118	1.000	1.035	1.053
Wt. of wings	379 lbs.	320	274	365	299	259
Total wt.	2579 lbs.	2520	2474	2565	2499	2459
Wing loading	7.14 lbs. sq. ft.	8.54	10.10	7.03	8.65	10.01
Power loading	7.76 lbs. H. P.	7.68	7.54	7.82	7.62	7.50
Fineness	122.8	117.5	112.5	122.8	117.0	112.5
y*	1.66	1.89	2.11	1.66	1.90	2.10
Velocity at ground	146.3 m.p.h.	149.0	153.0	145.5	149.5	153.0
Velocity at 10,000 ft.	145.0 m.p.h.	146.6	148.5	144.5	146.9	148 4
Velocity at 15,000 ft.	138.6 m.p.h.	139.7	141.3	138.1	140.1	141.0
Velocity at S. C.	109.3 m.p.h.	113.5	119.0	108 9	114.0	118.8
Climb at ground	1785 ft. min.	1595	1465	1770	1585	1480
Time to 10,000 ft.	6.6 min.	7.5	8.5–	6.6	7.5	8.4
Time to 15,000 ft.	12.2 min.	14.1	16.5	12.3	14.1	16.2
Time to S. C.	41.0 min.	41.3	41.0	41.5	41.2	41.0
Service ceiling	24,025 ft.	22,900	21,400	24,050	22,800	21,860
Velocity at 20,000 ft. (Interpolated from curves)	126.8 m.p.h.	126.7	126.6	126.5	127.3	126.0–

* y is the ordinate on the performance chart for the given power loading and fineness.

Several interesting facts were brought out in the computations for the six designs in addition to the main conclusions given above.

1. For a given aspect ratio and gap-chord ratio and varying wing loadings, the net area of spars tends to be constant. The areas of the spars of the design in question were not exactly constant, but the differences were apparently due mainly if not entirely to the variations in the efficiency with which the material was used. With the higher wing loadings the moments are smaller but this is counteracted by the decrease in the depth of the spars, so that the same sectional area must be used.

2. The direct stresses in the lift trusses do not vary with either aspect ratio or wing loading, but only with the proportions of the truss. A change in the gap-chord ratio or the ratio of cantilever length to length of bay will cause a change in the direct stresses.

3. With a given gap-chord ratio the size of the struts varies with the chord, but for a given aspect ratio the weight of struts per sq. ft. of wing is constant.

4. In Fig. I, the fineness is independent of the aspect ratio. Therefore, the effect on performance of a change of aspect ratio is only the negligible changes due to the variation in the structural weight and efficiency of the wings.

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* Air Service Information Circular, Vol. II, No. 183. McCook Field Report No. 1380.

INTERNATIONAL AIR TRAFFIC ASSOCIATION REGULATIONS

THE Air Traffic Companies, members of the International Air Traffic Association (I. A. T. A.) agreed at the last conference at Stockholm on some technical questions, aiming to bring in future a uniformity in the commercial aeroplanes to be used on their mutual airlines. In this way big inequalities regarding the flying and loading capacities, the equipment for the crew, the passengers and the airpost will be avoided, so that change and transhipment from one machine into the other can take place without difficulties.

All purely *constructive* requirements must be in accordance with the rules for admission, prescribed in the different countries, regarding the construction and safety.

With a view to *airtraffic* the following is pointed out:

Classification of Commercial Aeroplanes and Seaplanes

AEROPLANES

1st Class: Aeroplanes with a useful load to 200 K.G. and fuel for 600 K.M., wanted for flights of a few passengers (one or two persons), for the transport of small mails, telegrams and courier services, etc.

2nd Class: Aeroplanes with a useful load between 600-800 K.G.* and fuel for 600 K.M., wanted for the regular airmail service, the transport of 6-8 passengers (including a mechanic near the pilot) with luggage, resp. a freight of equal weight.

Third Class: Aeroplanes with a bigger capacity of useful load and a larger radius of action.

SEAPLANES

First Class: Seaplanes with a useful load to 200 K. G. and fuel for 400 K.M., wanted for flights of a few passengers (one or two persons), for the transport of small mails, telegrams and courier services, etc.

Second Class: Seaplanes with a fuel load between 500-800 K.G. and fuel for 600 K.M., wanted for the regular airmail service, the transport of 5-8 passengers (including a mechanic near the pilot) with luggage, resp. a freight of equal weight.

Third Class: Seaplanes with a bigger capacity of useful load and a larger radius of action.

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* The margin of load in the aeroplanes and seaplanes in the Second Class must enable the constructors to get the technical and economical advantages, which can be obtained with the actually existing engines, in accordance with the classification of the qualities.

Night Flying Machines require a special classification. As the experience in this matter is still small, they will not be considered for the present.

For the mutual airservices of the associated companies and the airservices of the other separate companies first will be considered

2 kinds of aeroplanes (First and Second Class)

2 kinds of seaplanes (First and Second Class)

The following *outlines* therefore treat specially these 4 kinds of machines.

Flying Capacities: Flying, the machine may not have any peculiarity nor tricks in any way. It must be possible to fly at calm weather during at least 2 minutes without touching the controls.

Cruising Speed (at a height of 1000 M.): Aeroplane (First Class) 160-180 K.M.; Aeroplane (Second Class) 180 K.M.; Seaplane (First Class) 150 K.M.; Seaplane (Second Class) 160 K.M.

Surplus in Motor Power: It is not allowed that the required cruising speed and the good flying properties can only be obtained by using the whole motor power. To fulfill these conditions about 2/3 of the total H.P. force must be sufficient during the cruising speed, so that the remaining 1/3 H.P. comes to the benefit of the climb and the combating of very unfavourable weather conditions and the general reliability. It must be possible to switch off the half by double engined aeroplanes and nearly the half by more engined aeroplanes (for instance by 5-2), without loss of height during the flight.

Climb with Full Load: Aeroplanes and Seaplanes: 0-1000 M.—I, 6 min.; II, 8 min. 1-2000 M.—I, 12 min.; II, 15 min. The start of the aeroplanes may not be more than 200 M. and the run not more than 150 M.

"Take Off" of Seaplanes (by calm sea without wind): Seaplanes I, not more than 20 secs.; Seaplanes II, not more than 30 secs.

Seaworthiness: Seaplanes I—Dash of the waves, 2-3; wind velocity, 6-9 M. sec. Seaplanes II—Dash of the waves, 3-4; wind velocity, 9-12 M. sec. Safe steering in the above mentioned wind and sea conditions.

Reliability

With a view to *airtraffic* the following points are considered as primal conditions:

1/3 surplus in motor power (see above).

A clear view on the engines.

Possibility of a quick exchange of the power plants.

Short and clear conveyance of cables and pipes, as well as of power transmission.

Use of armoured or metallic propellers.

The greatest possible limitation of danger of fire by:

Application of engines at which the timing of the valves for inlet and exhaust do not get mixed;

Favourable position of the tanks;

Fireproof partition between the engine-room and the passengers room, resp. the place of the crew.

On seaplanes all floats and boats must be provided with the necessary number of bulkheads.

The total carrying capacity of the floats or boats must be at least 30 per cent. bigger than twice the weight of the machine with full load.

A soft system of springs with a long jump and a great capacity.

Conditions for the Pilot

The pilot must have a good view in the front and on both sides, as well as below in the direction of the flight. His seat must be equipped comfortably. The machine must be constructed so that the pilot is safe when it turns over.

The foot controls must be adoptable to the length of the body. When the passengers capacity is more than 6, the machine must be provided with a dual control and an entrance from the seat of the pilot into the passengers cabin.

Conditions for the Passengers

The passengers cabin must be strongly built and equipped with all practical comfort required for the journey. The experience of modern body building must be applied hereby.

Every seat must be at least 55-60 c.M. wide; every seat must be at least 55 c.M. broad.

The height above every seat must be at least 95 c.M. and the space for the knees must be at least 30 c.M.

On all seats it must be possible to stretch the legs.

It must be possible to open all doors from the inside.

It must be possible to have a conversation in a cabin—without speaking loudly—by the decrease of the noise of the engine and the construction of the cabin.

The possibility of speaking with the pilot must be provided.

Belts, strips or handles must be provided for all passengers.

The windows must be placed so that it is possible, when sitting, to have a good view. The most important windows must be so large that they can be used as emergency exits.

Ventilation and heating must be provided.

It must be possible for the passengers to get as quick as possible out of the machine, in any position, also when turned over.

Instruments

The pilot must have a clear view on the following instruments:

1 Height indicator,
1 Speed indicator,
1 Revolution counter,
1 Petrol gauge,
1 Compass,
1 Watch,

as well as on the indicators and levers, pointing out the position of the machine. (A thermometer for the radiator water, a direction indicator, an indicator for the horizontal position of the machine, are desirable.)

The compass must be placed so between the seat of the pilot and the direction of the flight, that it is possible to control it without turning the head.

Wireless

The aeroplanes and seaplanes of the Second Class must be equipped with wireless.

The receiving and sending wire must not dangle underneath the machine.

The sender and the receiver of the wireless must be placed in the room, which is specially made for the mechanic. If the signals are received by sounder system, it must be possible to hear them by the engine running on full throttle.

Tank Capacity

By a start with full load (see above) it must be understood that the aeroplanes, besides the useful load, must be charged with fuel for 600 K.M. (by the seaplanes I for 400 K.M.), but the tanks must have a capacity of:

Aeroplanes, First Class....for 800 K.M.
Aeroplanes, Second Class..for 1000 K.M.
Seaplanes, First Class......for 600 K.M.
Seaplanes, Second Class....for 800 K.M.

Conditions for the Luggage

In the cabin for the passengers there must be sufficient room for small luggage. In a special luggage room it must be possible to put 2 trunks 80x50x25 c.M., when it is an aeroplane or seaplane of the First Class; and 6 trunks 80x50x25 c.M., when it is an aeroplane or seaplane of the Second Class. It must be possible to lock these luggage rooms.

Besides these, in aeroplanes and seaplanes of the Second Class a special space of the dimensions 50x50x50 c.M., which can be locked, is wanted for the airmail.

Possibility of Transport

When the wings are taken off, the machine must be transportable in an easy way and it must be possible to send it on a normal open railway car without complicated dismounting, according to the railway prescriptions concerning form and dimensions of freight. The seaplanes must be equipped with a liftstrop. This is also desirable for aeroplanes.

Classification of the Qualities

If the construction is the same and the general good flying properties also (including seaworthiness by seaplanes) the differences of qualities in one class of machines can be indicated by the following classification:

I.

Principol Technical Conditions:

1. Difference between the greatest and the lowest speed.
2. The lowest landing speed.
3. The greatest cruising speed.
3a. "Take off" qualities, seaworthiness and steering possibility of seaplanes.
4. View of the pilot.

II.

Principal Economicol Conditions:

1. Lowest use of fuel pro K.G./K.M.
2. Price of purchase.
3. Weatherproof and repairing possibilities (lifetime).
4. Lowest costs of maintenance.

III.

Other Technical and Economical Conditions:

1. Surplus in motor power.
2. Preferable constructions of motor plants.
3. Flying properties of the machine by suppressing H.P. and great difference in weight of the load.
4. Immunity of the engines for fuel of different nature and for different temperature.
5. General construction concerning safety measures for the crew, the passengers and the freight. Dual control, constructive perfection of the passengers cabin, possibilities of getting out of the cabin in case of accident or turning over.
6. The best center of gravity by changeable weight (fuel, load); easy stowing possibility.
7. Practical comfort for the passengers, as well as practical conditions for the loading room.
8. Possibility to change the landing gear for landing on the ground, the sea or the snow, as well as general possibilities for mounting, dismounting and transport.
9. Easy change of the cabin for the transport of persons or freight, for nice or bad weather, for summer or winter service.

BALLOONING: ITS USE IN SCIENCE AND SPORT

By MAJOR C. C. TURNER*

IN the triumph of the aeroplane and the airship the round balloon, which has no means of propulsion or of direction-control, has suffered a certain neglect. Throughout its history the balloon has served sport and the showman rather than science, although it has rendered valuable services to meteorology. And in the form of *ballons sondes*—small unmanned balloons with automatic recording instruments—it is still used by the meteorologist, as also are kites. But since personal observations are often of great value, balloonists should still be able to do good work; for, unlike the aeroplane, the balloon is perfectly noiseless and without vibration.

During the first stage of the training of airship pilots the round balloon provides the cheapest and best introduction to the practical application of the science of aerostatics. No amount of theory or of lecture-room experimenting can give the pupil so practical a knowledge of the effects of small variations of temperature and atmospheric pressure, to which balloons and airships are extraordinarily sensitive. It might be possible to dispense with the course of "free ballooning," but it is the best and the least expensive way of securing the best results. During the war it was established as part of the training of airship and kite-balloon officers.

Fascinating Sport

Outside these the balloon's sole claim is in the field of sport and recreation; and here it inspires enthusiasm among its votaries, but makes little appeal to the mere spectator. It provides a safe and easy means of exploring the air, of seeing wonderful airscapes, and of getting in a few minutes out of the impure atmosphere of the town into clean air and bright sunlight. It gives a spice of adventure, and landings which have no element of danger except in very rough weather (when no one need go up), provide endless variety. It calls for the exercise of skill and judgment; yet almost any man or woman, with very little instruction, can become sufficiently expert to take charge.

The high price of coal gas, and the universal post-war depression of spirit, have prevented a revival of ballooning, and Great Britain has suffered more than other countries. For one thing, Great Britain is physically handicapped, having the sea at no great distance from any inland point, and the prevailing winds being across its narrower dimensions. A balloon goes with the wind, but the pilot can ascend or land at will. France, Germany and America enjoy the great advantage of large area.

Nevertheless, there would have been a revival of ballooning in this country but for the price of gas and the inexplicable difficulty of obtaining from the Aircraft Disposal Board the balloons that were used for training during the war. The present writer knows of cases where applications were perserveringly made in 1919 for these balloons. Applicants were assured they would be communicated with; but nothing came of it, and presumably the balloons are now rotting away. If it was the desire of the authorities to prevent any undue revival of what might have been regarded as an extravagance, surely they could have left it to the operation of circumstances: the price of gas would have checked it, to say nothing of labor difficulties. Anyway, there are dozens of men who obtained their balloon "ticket" during the war who have been eager to go in for the sport.

Possible Cheap Ballooning

The Gordon-Bennett race is a test of skill. Although there is nothing difficult in the art of ballooning, the prolongation of a voyage to the utmost possible, and the wise use of currents of the air, call for watchfulness and experience. A certain amount of luck comes in, but it is usually skill that wins the Gordon-Bennett.

Until gas gets cheaper it is not likely that ballooning will regain popularity. At present the cost of a quite ordinary trip in England would work out at not less than £5 per passenger. A way out of the difficulty is suggested by the employment of hot air instead of gas, but not by the use of a furnace merely filling the balloon at the start, as in the old days. The scheme referred to was proposed by a Frenchman, and consists of a specially contrived petrol (or other oil) stove carried under the neck of the balloon so that the pilot could regulate the heat as desired. This has not yet been brought to mechanical practicability, but there appears to be no insuperable difficulty in it.

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* Reprinted from the *London Observer*.

French Aero Show

Wilbur Wright probably would rub his eyes in sheer amazement were he able to witness the wonders accomplished with his idea by French manufacturers as shown in the aviation exhibit at the Grand Palais. Many details of the machines have been kept secret for the opening of this show, which is the first the manufacturers have had in two years.

The inspection which the New York *Herald* correspondent was privileged to make of the latest machines shows that France does not intend to yield the supremacy either in civilian or military machines to other nations if she can help it. Simultaneous strides are being taken in both fields but while in the civilian branch the movement is entirely for greater carrying power and mammoth construction, so far as the military machines are concerned speed alone seems to be the guiding factor. Here are some of the latest wonders.

1. A flying hospital equipped with stretchers and able to carry a doctor and an assistant to perform regular operations in the air. There is an operating table, a full medical equipment and two patients can be carried on the stretchers. The machine is equipped with stabilizing appliances which will enable the doctors to work just as if they were in a city hospital. This is a Breguet biplane capable of developing a speed of 100 miles an hour.

2. An aerial monster, also a Breguet, capable of carrying twenty-four passengers as well as a crew of three and able to attain a speed of 150 kilometers an hour. It is the last word in aerial comforts, containing a bathroom, smoking room, card tables and a kitchenette. The seats are so arranged that they can be changed into beds for night voyages.

3. A Farman biplane with 100 foot wingspread and four 250 horsepower motors, capable of carrying twenty persons. It resembles a great sailing ship with six masts on each side of the cabin, the Farman running to wingspread in order to gain stability.

4. A Breguet hydroplane with places for five people, the fuselage and floaters being made entirely of metal.

5. A new Breguet triplane, all metal, with a group of 500 horsepower Breguet motors designed for war but not yet ordered by any Government. This will carry five machine guns and their crews or two tons of bombs.

6. A Bleriot seventeen passenger touring plane, with two seats on the tail of the machine for seasoned travellers. This machine has a lookout cabin for the navigator and is equipped with wireless telephone and telegraph, searchlights and signal flares, and also carries a petrol reserve above the wing tips as a solution for the fire danger problem.

7. A La Tecoere, 1,000 horsepower machine with three motors. Two of the motors are outside of the fuselage, attached to the cabin by braces rather than to the wing braces, and equipped with an interior drive.

8. A new all metal Fokker monoplane with two seventy horsepower Meyback motors, capable of carrying six passengers.

The French army is represented by two pursuit planes, a Nieuport and a Spad of twenty horsepower each, with two places, carrying two machine guns and capable of developing 130 miles an hour, or a 75 per cent. advance over war time construction. The army has also adopted a Breguet stretcher carrying biplane, with the stretchers arranged lengthwise, and no provision for attendants, as it is designed to carry urgent cases from the battlefields to the hospitals.

Postal Plane Gives Quick Carriage to Arlington Films

Mineola, L. I.—On the authorization of Postmaster General Will Hays a De Haviland type of mail plane arrived from Washington the evening of Nov. 11th with films and photographs of the Armistice Day exercises at Arlington Cemetery. The plane was piloted by Paul M. Collins. It carried 150 pounds of films and plates for various motion picture corporations.

NAVAL *and* MILITARY AERONAUTICS

General Summerall Commends Air Service

During a recent inspection by the new Commanding General of the Hawaiian Department, Major-General C. P. Summerall, of the Air Service troops at Luke Field, H. T., an aerial demonstration of attack raiding, camera obscura training, acrobatics, two way radio, radio phone, and Fokker stunting was given, which resulted in the following letter of commendation from him to the C. O., Luke Field:

"1. I desire to communicate to you and through you to the officers and soldiers of your command an expression of my satisfaction with the efficiency in every department as evidenced during my inspection yesterday and of my commendation of the personnel in all grades whose loyalty and devotion to duty have produced such pleasing results.

2. The exhibition in the functioning of the Air Service in its different tactical missions was unsurpassed by anything that I have seen. The organization and the functioning of the different departments for the maintenance and operation of the command inspire confidence in the methods pursued for safety and efficiency. I especially wish to commend the experts and the officers in charge of the different scections for their resourcefulness in developing capacity and securing continuity where special training is required.

3. While I might commend each officer by name for his particular achievements, I wish especially to express my appreciation of the demonstration given by Lieut. Miller while flying as an escort during my journey to and from the Island. I wish also to commend the work that is being done by Lieut. Miller in the shops and of Captain Oldys who has demonstrated unusual efficiency in his capacity as Operations Officer."

Engineering School, McCook Field, Dayton, Ohio

At the present time the Engineering School at McCook Field is busily engaged in the study of shop machine work. Recently a tour of inspection was taken of the National Cash Register works, and this plan will be continued throughout the course of study so that the student might get first hand data as to practical methods of production and machine shop routine.

There are 16 officers now enrolled at the school, as follows: Majors A. H. Hobley, Follett Bradley, George E. Lovell, Jr., Henry L. Watson, Howard C. Davidson, Captains Hervey W. Cook, Henry Pascale, Robert L. Walsh, Lieutenants Burton F. Lewis, Oscar Monthan, Carlyle H. Ridenour, Robert S. Worthington, E. A. Palmer, Walter E. Richards, Harold R. Harris and Richard E. Thompson.

Exhibition of Armored Aeroplanes at Bolling Field

The recent exhibition at Bolling Field of an armored aeroplane built by the J. L. Aircraft Corporation of New York City was a most interesting one, inasmuch as this machine marks one of the very first all-metal aeroplanes entirely constructed in this country. While the outward appearance of the aeroplane is nearly identical with that of the J.L. 6 exhibited a year ago, numbers of which were purchased by various government agencies, the construction of the new machine is considerably different.

The plane, known as the "J.L. 12 Attack Plane," is a type in advance of the latest foreign all-metal planes. It is 32 feet long, with a wing spread of 49 feet, and carries 130 gallons of gasoline. It is equipped with a 12-cylinder 400 h.p. Liberty engine, and has a newly designed internal metal bracing system, employing considerably more steel than that in the J.L. 6, which employed mostly duralumin. The duralumin sheathing and wing coverings of the latest model are more than twice as thick as that used on the J.L. 6, and the duralumin itself, which has been developed and produced entirely in the United States, is said to be far superior to that produced in any other country.

All vulnerable parts of the plane and the crew are protected by 3/16-inch armor plate. The armament consists of 30 Thompson .45 calibre machine guns, so arranged as to fire downward at a slight angle to the vertical. Two machine guns are flexibly mounted so as to be used independently by the pilot for firing either upward, forward or to the side. The machine guns arranged to fire downward are so controlled that their action is begun and controlled by three levers, one firing half the battery, another the other half, and the third, or master lever, which puts all of the 28 guns in action with a single motion.

The machine is designed as a ground straffer. It was flown from Bolling Field over the Potomac River near the Army War College, and as a demonstration all of the guns fired into the river. The demonstration was apparently very successful. A speed of 140 miles per hour is claimed for this plane, with greatly improved climbing and maneuvering ability. When manned by pilot and gunner and equipped with 3,000 rounds of ammunition and fuel for 500 miles of flight, it weighs 5,000 pounds.

Navy to Test Dornier Boat

Washington.—The Navy Department is arranging for a special demonstration of the German Dornier all-metal flying boat, to be held at the naval aircraft factory in Philadelphia for the benefit of aeronautical manufacturers and engineers.

Secretary Denby said that it had been the policy of the Navy Department to purchase abroad examples of metal construction in order to study the latest development in the art. These tests at Philadelphia will include demonstration in flight of the Dornier flying boat, which is a post-war product of the Zeppelin Company, and was originally designed for commercial passenger service. Several other examples of foreign construction will be available for the detailed examination of the engineers invited to witness the demonstration.

Film Shipment by Air

A complete aerial delivery system for film shipments aggregating ten thousand pounds weekly from the San Francisco exchanges to scores of theatres in the Northern California and Nevada territory was arranged during the week of October 23rd to meet the threatened railroad strike.

The proposal for the aerial delivery was made to the San Francisco Film Exchange Board of Trade by Glenn Hurst, secretary of the Pacific Airline Company. Mr. Hurst has been for the past ten years engaged in the motion picture exhibition business in Nevada, but is now handling exploitation for the financing of the new company.

At a meeting of the members of the film board of trade on October 25th a large fund was subscribed to inaugurate the air service and defray the added cost of aeroplane delivery as against rail delivery which is paid by the theatre.

The San Francisco exchanges which supply nearly 350 theatres, apportioned the service between auto trucks and aeroplanes. Routes where trucks could traverse paved highways in a reasonable time were allotted to the ground service. More distant stations were allotted to the airlines. The air service was scheduled to start on October 31st and covered three trunk lines. Route No. 1 had its terminus at Eureka, California, 250 miles by air, with Santa Rosa and Willetts as intermediate landing stations. Route No. 2 terminated at Klamath Falls, Oregon, 350 miles by air, with landings at Chico, Red Bluff and Redding, California. Route No. 3 had its terminus at Reno, Nevada.

From each of the landing stations the theatres within a radius of twenty-five to thirty miles would call by automobile for their shows. Some seventy theatres were included in the proposed service with four round trips each week over the routes. With the suspension of rail service to Nevada points the air service was the only means for delivery. At this season of the year all automobile routes to Nevada over the Sierras are closed by early snows.

The fleet of planes operated by Walter T. Varney, consisting of one Bristol, four Lincoln Standards and two or three other craft were chartered for the bulk of the carriers. Practically all of the planes owned by private flyers in San Francisco would have been required to carry out the plan, including the Friesly Falcon, the giant two motored craft now stationed at the Marina which could have negotiated the routes with a ton of cargo. Mr. Varney gave all his planes and spare motors a complete overhaul in preparation for the service.

Rates for film shipments by air would have been about double express charges by rail. The charges which were fixed were very moderate considering the emergency.

The weekly rental collections of San Francisco film exchanges are about $60,000 and the take of theatres receiving the air delivery is an equal amount.

Close to 50,000 pounds of film shipments are round tripped weekly by parcel post and express in the San Francisco territory alone, and this district is estimated at 3½ per cent, of the United States.

FOREIGN NEWS.

Prospective Developments in Holland

With a view to ascertaining the attitude of the Dutch Government towards civil and military aviation, the manager of S. Smith and Sons' Aviation Department, Mr. A. W. Hulbert, recently paid a visit to Holland.

He states that as a result of the Queen's speech at the opening of Parliament, calling for drastic economy, the Government does not propose to help the civilian transport companies to any extent for the next six months. They will, however, continue the present scheme of subsidizing the lines to the extent of two-thirds of the total loss incurred in working. This seems to suggest that it would pay a firm to lose money, either by investing the profits in new machines or experimental work in order to qualify for the subsidy; which is surely an Irishman's (or a double Dutchman's) way of encouraging civilian flying.

During an interview with a high official at the Government Aerodrome at Soesterburg Mr. Hulbert brought the conversation round to the question of the Dutch Government's programme for next year, and was informed that specifications were in course of preparation, and that in the early part of 1922 tenders would be invited from firms at home and abroad for machines built to these specifications. This means that British Aircraft Constructors will stand a chance of getting in, providing that their price and delivery compare with the Dutch manufacturers; Fokker being perhaps the most formidable competitor.

The types at present in use at Soesterburg are Fokker and Spyker school machines, a few Bristol Fighters, D.H.9s, and a number of small s.s. Fokker machines. Soesterburg is situated about 15 kms. E. of Utrecht, and combines an experimental station and an advanced training establishment for naval and military pilots. The training is divided up into three sections: aerial gunnery, general flying and W/T. With regard to photography the Dutch have a lot to learn yet before they can claim to have attained the standard of excellence set up by British aerial photographers, either civil or military.

In view of the complex network of canals throughout the whole of Holland, Mr. Hulbert is of the opinion that the Dutch aerial taxi of the future will be a two- or three-seater seaplane, about the size of an Avro "Baby," which will be able to take off and land on most of the inland waterways with comparative ease. Anything on a larger scale would be out of the question for serious work everywhere in Holland, as a larger machine, on account of its size, would be confined to a few of the largest canals and its sphere of usefulness narrowed considerably.

Paris-Bucharest in 14 Hours

For some time it has been the intention of the Franco-Roumanian Aviation Co., who operate the Paris-Strasburg-Prague-Warsaw air line, to extend their line to Bucharest. On October 22 the first direct flight was made, and occupied 14 hours, including the stops at Strasburg, Prague, and Budapest. By train the journey occupies about 63 hours, so that the saving effected is very considerable.

Austria's War Material

Official figures just issued in Vienna of war material destroyed or delivered up by Austria up to October 1 under the terms of the Armistice and Treaty of Peace, include 1,333 flying apparatus, 3,289 aeroplane motors, 15,000 magnetos and instruments, and 2,500 aeroplane machine guns.

France to Have an Aircraft Museum

To replace the temporary resting-places of the historical collection of objects relating to air navigation which have hitherto been deemed adequate in France for the purpose, a new "museum" is to be formally inaugurated on November 23 at Chalais Meudon. "La France" hangar is to be utilized to this end, and the public will then have an opportunity of conveniently studying the many interesting "relics," etc., which have been collected relating to the past history of aviation.

Poirée Fails to Beat Martinetti

As soon as it became known that the Italian aviator Martinetti had improved upon Poirée's time in the fight for the Coupe Michelin, Poirée set out to see if he could beat his own previous performance and also that of Martinetti. Altogether he made three attempts, none of which was successful, chiefly on account of bad weather conditions, but although he has failed to beat Martinetti's performance of 3,000 kilometres in 35 hours, he has put up the very fine performance of covering 7,000 kilometres in one week.

Mesopotamia Air Force

It is now officially announced that from February 1, 1922, the Irak (Mesopotamia) Group of the Royal Air Force, which is at present part of the Middle East Area, will be separated from that area, and will become an independent command. The officer commanding Irak Group will be directly responsible to the Air Ministry for the command and administration of the Air Force units located in that country.

Gliding Competition in France

Encouraged by the success attained during the German gliding competition in the Rhone hills this year, France has resolved to hold next year a somewhat similar competition. At present it is proposed to hold the competition from July 6 to 20, 1922. The competition is to be organized by the French Aerial Association, but before settling the rules and regulations it is proposed to call a "Congress" at the Grand Palais to discuss the possibilities of such a competition. The congress is to take place on November 26 and 27 in one of the lecture halls of the Grand Palais, and the only condition imposed for admission to this congress is that a communication should be made to the *Congrès d'Aviation sans Moteur,* addressed to the General Secretary, M. Georges Houard, 17, Boulevard des Batignolles, Paris (8^{e}). The communication should bear on the following subjects: Theory or application of gliding flight; method of making the experiments; information relating to the Rhon experiments; rules and regulations of the French competition in 1922, or suggestions concerning the competition, such as suitable place for holding it, rules and regulations, etc. Communications should not exceed 1,200 words, and those accepted will be published in our French contemporary *Les Ailes.*

New Italian Airship

From Rome it is reported that Italy proposes to build another semi-rigid airship, the "Napoli," on somewhat similar lines to those of the "Roma," which was sold to America recently, but of rather greater length. The ship is stated to be designed for 100 passengers.

Antihes to Ajaccio in 3 Hours 10 Minutes

France is gradualy turning the port of Antibes into an important air station, and it is hoped to establish air lines running to Corsica, Sardinia and Tunis, using Antibes as the French terminus. On October 18 a seaplane flew from Antibes to Corsica (Ajaccio) in 3 hours 10 minutes, which is a very great saving of time as compared with the time taken by steamer.

The Pescara Helicopter

After numerous trials, and after having rebuilt his transmission and other details of his helicopter, M. Pateras Pescara is now reported to be satisfied with the behavior of the machine, and to have succeeded not only in making it rise on several occasions, but also in lifting at will one end or the other, in turning, and in descending slowly. No attempt has yet been made at high flights, nor at completing a circuit, as the garden in which the machine is being tried is too small to allow of this. We understand, however, that the machine is being dismantled, and will be exhibited at the forthcoming Paris Aero Show. After the closing of the show it is to be thoroughly tested in France, at Villacoublay, before the French Service Technique, when prolonged flights will, presumably, be attempted.

The Aveline Stabilizer

The inventor of the "Automatic Pilot," M. Georges Aveline, has been demonstrating his stabilizer in France. When we met him in London recently he told of experiments having been made on French machines at Villacoublay. He also referred to the possibilities of the invention being taken up by America and other countries, so that there would appear to be prospects of the stabilizer (which was described in detail in *Flight* of February 3, 1921) coming into fairly general use during 1922. Some little time ago a demonstration was given on one of the to Brussels, Rotterdam, Amsterdam and back. On this particular occasion the lateral stabilizer only was used, but we understand that the M.A. were machines belonging to the Messageries Aériennes, which flew from Paris so pleased with the results that they have asked for a demonstration with the elevator stabilizer fitted also.

A New Metal?

From Paris it is reported that two French inventors have discovered a new light metal, which, if the claims made for it are substantiated, should have a great future in the aviation industry. The new metal is stated to be lighter than Duralumin, stronger weight for weight, and much cheaper. The tests are stated to have been carried out in the laboratories of the Arts et Métiers, and to have proved that the metal does have extraordinary properties. The inventors are MM. Fontane and Geyer. We seem to have heard of similar wonderful metals before, but somehow they have a habit of not materializing. We trust the French inventors will have better luck, since such a metal would help metal construction considerably.

Italy Re-Names Her Aerodromes

Many Italian aerodromes are being re-named after Italian air heroes, the consent of the Ministry of War having been obtained for this procedure.

The Baggio (Milan) airship station is to be known by the name of Remo La Valle, the second in command of the M. 12 airship, who perished when this airship was shot down from Monte Hermada by the Austrians.

The Bologna (Piazza d'Armi Capara) aerodrome has been dedicated to the memory of Fausto Pesci.

The Capodichino (Naples) air port takes the namee of Ugo Niutta.

The Ghedi aerodrome will be dedicated to the memory of Luigi Olivari.

The aerodrome of the Cascina Costa (Gallarate) School will be dedicated to the memory of Gaspare Bolla.

The name of the Taliedo aerodrome has been altered to that of Emilio Pensuti, in honor of that pioneer airman, who was killed in an attempt to land a Caproni triplane which had caught fire at a height of 3,000 metres.

The Air Port of Prague

Prague is slowly but—let us hope—surely becoming an air port of some importance, a position to which her geographical situation would appear to entitle her. The aerodrome is situated at Kbely, a small village on a plateau to the northeast of Prague, forming a splendid natural site for an aerodrome. It is here that the machines from Paris, which depart from Le Bourget at six in the morning, arrive round about two in the afternoon, leaving again for Paris the next morning at 11:30. In addition to this daily service to Paris and Warsaw, Prague will, during the next few months, also have its service to Budapest, Belgrade, Bucharest, Dresden, Berlin, and Constantinople. For the extension to the Turkish capital a new machine has been ordered.. This is, we learn with some surprise, one of the fur-engined Blériots (presumably the "Mammouth,") one version of which was exhibited at the last Paris show. The new machine is stated to have accommodations for sixteen passengers with luggage, and to have an average speed of 120 m.p.h., with four engines of 300 h.p. each. Even accepting the speed, 75 h.p. per pasenger does not impress one as a particularly good commercial roposition.

French Aeroplane Construction

A London financial journal states that the French Military Air Service will next year have over 40,000 aeroplanes, if the Army budget passes. The French Flying Corps would then be composed of 286 regiments, each of 12 squadrons. French aeroplane constructors are at present in a very strong position, mainly because the French Government did not cancel all its war contracts, but allowed constructors to execute the greater number of them. It was thought that this would be the best way of subsidizing the French air industry.

In addition, the French constructors had in hand substantial orders from Japan and South America. It is to this policy and to the most intelligent cooperation of the French military technical services with civilian aviation that France owes her present lead in the air.

ELEMENTARY AERONAUTICS and MODEL NOTES

The Possibilities of Soaring Flight

By soaring flight (in contrast with gliding flight) is meant, *motorless flight without loss of height*. According to the laws of the mechanics of flight, two sources of energy are available for soaring flight. One is, air currents having an upward trend; the other is, irregularities in the natural wind. Under the latter head, distinction can be made between two effective forms: (1) Great fluctuations in the strength (and also direction) of the wind, lasting several seconds; (2) The rapid fluctuation in wind direction which is commonly described as "turbulent wind."

The fluctuations of long duration can be utilized only by effecting considerable changes in the velocity and height of the machine. For instance, by climbing at the expense of relative velocity, in one single gust, and then, in the calm which follows, gliding with a downward acceleration. The procedure to follow in order to extract energy from the wind can be condensed into a simple rule: *One must attempt to equalize the fluctuations in the wind.* In so doing, the energy in the wind fluctuations is obviously reduced and the energy of the machine increased by a corresponding amount. Thus, for instance, one must present great resistance against a gust, small resistance against a lull; in an upward current the machine must be gradually elevated to increase the presure on the wings; in a downward current, depressed to decrease the pressure.

The fluctuations of short duration, on the other hand, can be utilized without any substantial change in velocity of the center of gravity of the machine.

Useful effect is available in sufficiently great fluctuations in wind direction even with rigid and non-warped aeroplane wings. With elastically mounted or flexible wings, the force obtained from changes in wind direction, if these be sufficiently great, may assume perceptible proportions. The effect may be imagined as resembling that of the so-called "fish-tail" propellers. This name has been used to designate an arrangement by which the waves of the sea have been utilized for the production of power. The arrangement consists of a number of flexible plates, rigidly attached with their leading edge to the sides of a ship. As the waves rise and fall, the plates bend like the tail of a fish, and produce power both when bent downwards and when bent upwards.

Sources of Energy Used by Birds

When we now come to the question of which of these sources of energy do soaring birds make use, the answer can only be that, if not exclusively, at any rate mainly, they take advantage of rising currents. Rising currents are always to be found in uneven country when a wind is blowing. They are also caused over the plains by meteorological influences.

Rising Air Currents

For their flying practice, birds naturally seek the rising air currents, and as these are frequently not of very great extent in space, the birds have to circle in order to remain in the rising air currents. By observing the soaring of birds of prey one may frequently see that they suddenly lose height and then commence to flap their wings, continuing in flapping flight until they are seen suddenly to rise. From this moment onwards they again commence to soar. They have again found their rising current which they had previously lost.

The soaring seagulls near a steamer make use of the air deflected by the steamer and commence to flap as soon as, for some reason or other, they leave their favorable position.

Gusts and Wind Fluctuations

That a bird intentionally makes use of gusts does not appear to occur generally. In order to do so, it would have constantly to make jumps up and down, which it has not been observed to do. On the other hand, it does not appear unlikely that many birds utilize the rapid fluctuations in the wind besides, after the manner of the fish-tail principle.

Probably, however, these forces suffice in no case to cover the entire work of flying, so that the axiom "no soaring without a wind with an upward trend," can probably be accepted as correct.

In regard to sea-birds, each individual wave gives the wind an upward deflection which the birds take advantage of.

According to a German writer, E. H. Hankin, whose recent book describes observations of birds, dragon-flies and flying fish, soaring by turbulent wind only is said to be possible when the earth is strongly heated, as occurs in the tropics.

Human Soaring Possibilities

In the case of human soaring flight, all the previously mentioned possibilities of making use of the energy in the air hold good in principle. The fish-tail effect may possibly be utilized by a suitable form of flexible wing-sections, although experiments with crewless models. It is quite probable that the wind fluctuations, which such wings would be designed to utilize, might frequently not be of such magnitude as to have a perceptible effect.

In view of the probable inconsiderable gain to be expected, one would not like to risk the uncertainty of the flying qualities of such a flexible aerofoil, which might easily lead to a useless, or even dangerous machine. A crewless model, on the other hand, could more easily be sacrificed.

The utilization of great wind fluctuations is a question of the skill of individual fliers. It is conceivable now and then to extract a slight gain from these, but too much should not be expected from this source. There then remains, as the most important help to human soaring flight, air currents with an upward trend.

The Advantages of Slow Rate of Descent

If it is desired to utilize to the fullest extent rising air currents, one must strive to build machines with a slow rate of descent. One is then in a position to utilize all rising air currents whose vertical component is greater than the rate of descent of the machine, provided that, at the same time, the upward slope of the wind is greater than the best gliding angle of the machine.

On a slope which is steeper than the best gliding angle of the machine, it is moreover possible to soar in winds whose velocity is smaller than that of the lowest gliding speed of the machine, provided the rate of ascent of the wind is greater than the rate of descent of the machine. In this case the machine will soar out horizontally into the free air and will obviously rise in doing so. In time, however, it would get outside the region of the ascending wind, but if the slope has sufficient breadth, the machine can be pointed diagonally to the slope and pass across it at the same height or climbing slowly. This method of flying can often be observed on seagulls over the beach. Under similar conditions the method should be possible of execution by human beings.

The above information is supplemented by four pages containing formulas to determine the conditions for the smallest possible rate of descent, in a pamphlet entitled, "Some Remarks Concerning Soaring Flight", issued by the National Advisory Committee for Aeronautics, under date of October, 1921.

Long Island Flight Association Formed

On November 7th, an association was formed at Baldwin, L. I., principally for the purpose of experimenting with and fostering the subject of gliding and soaring flight, and also for the furtherance of subjects pertaining to aeronautics in general.

Beginning with ten charter members, it is expected that there will be a great many young men near New York City who are anxious to join such an organization, and although no special efforts are being made to increase the size of the association, invitation to join is extended to those sufficiently interested in the subject.

The members are all employes of the Aircraft Department of the Ordnance Engineering Corporation. The membership roll is as follows: G. A. Page, Jr. (president); H. B. Shields, (vice-president); R. C. Greenwood (secretary-treasurer); W. Swenson, W. H. Schultz, W. F. Schult, A. O. Heinrich, G. W. Baumwart, G. F. McLaughlin, J. M. Beck, Jr.

A. O. Heinrich is one of the veteran Long Island pilots; furthermore, he has been a keen student of bird flight and at one time was engaged by the American Museum of Natural History to collect specimens of birds for exhibition mounting. Being interested in the subject from a flyer's standpoint, his knowledge will add much to the success of the contemplated soaring and gliding machines. George A. Page, Jr., also a pilot, has made interesting observations of bird flight, especially in the South, where he has been piloting an H-16 flying boat. Nearly all the other members have experimented with models and have been connected with the aircraft industry for several years.

'Twas Bestus

There was a stage star named Celestus:
When she danced the applause was tempestous;
She whirled and she tripped
'Til her shoulder-straps slipped—
And they had to ring down the asbestos.
—*Lord Jeff*

SHE (*kissing him again*)—You know I never do this to anyone else.

HE (*absently*)—So my friends tell me.—*Purple Cow.*

CLASSICAL DANCER—Doctor, I want to be vaccinated somewhere where it won't show.

DOCTOR—My dear young lady, I'm afraid I'll have to do it internally.—*Jester.*

Crushed

NO. 13 SHOE (*at a dance, having just stepped on a girl's foot*)—Pardon me, but I couldn't help it.

No 4—Of course; I should have climbed on a chair when I saw you coming.—*Record.*

She signed the first one—Your H. P. Q.
The second—Yours sincerely.
The next one—Very sincerely.
Then it was—As ever.
Soon she wrote—Your own—
And later—Love.
Finally it came—Your beloved wife.
After that she merely signed them:
Be brave but careful, boys!

Behind the Scenes

INSTRUCTOR TO ACTOR—And then you clasp her in your arms and kiss her madly.

ACTOR—Is that all?

INSTRUCTOR—Sure, you idiot! Don't forget there will be people looking.

"Were you ever paddled in a canoe?"
"No, but I've been thrashed in a barn."

EENY—I hear Jim has the golf habit.

MEENY—Oh yes, it's one of these loud, hairy things.

Should a body meet a body
Going through the rye,
And a body gets a swig,
Should a body sigh?

Should a body hang around
Wade right through the rye
And the body get real lit,
Should a body cry?

Boys, we ask yuh!

"My girl reminds me of a cow."
"How come?"
"She recognizes the bull every time I try to talk."

The Charge of the ? Brigade

(With Apologies to Tennyson)

Snores to the right of him,
Snores to the left of him—
Snores all about him—
Rumbled and thundered.
Nodded a head in sleep,
Lost there in slumber deep
While on the prof did keep,
And all the class slumbered.

Called on one sleepy stude,
Asked him a question rude
When on his feet he stood,
My!—how he blundered.
His—not to reason why,
His—but to do or die;
He made such a noble try,
Even prof wondered.

So through the happy days,
Under the sun's warm rays,
Idly the student plays—
Rarely he ponders.
How do they get that way?
Training for the world with play;
"Still, they're pretty good," I'll say.
And so the world wonders.

I saw her leap into the foam;
This maid so fair, so young, so trim;
I sat and watched her as she sank
And knew the while she could not swim.

She sank forever 'neath the waves;
I could not aid her in her plight;
It sure was good, don't miss it, Jim—
I saw it at the show last night.
—*Orange Owl.*

WILLIS—Between the two of us, what do you think of her?

GILLIS—Not so good, but alone—I'd love her.—*Tiger.*

To a Dry-Ad

Whatever else may happen now,
The country has gone dry;
The sailor still will have his port,
The farmer have his rye.
The cotton still will have its gin,
The seacoast have its bar,
And each of us will have a bier,
No matter who we are.
—*Punch Bowl.*

Modern Mathematics

The shortest distance between two pints is a straight line connecting two drug stores.—*Far Seas.*

Hold That Lyin'

TEACHER—What made you so late this morning?

JOHNNY—A car hit me and knocked me so cold I didn't thaw out for an hour.—*Chaparral.*

BARBER (*to sleepy customer*)—I cannot shave you, sir, unless you hold up your head.

SLEEPY CUSTOMER—All right, give me a hair cut, then.
—*Jester.*

Not To Speak Of

I see the girls gave back all frat pins
Those you see are very few—
The truth is simple and convincing
There's nothing left to pin them to.
—*Froth.*

"Father, did God make me?"
"Yes, my child."
"And did he make you, too?"
"Yes."
"Well, he's doing better work now, isn't he?"
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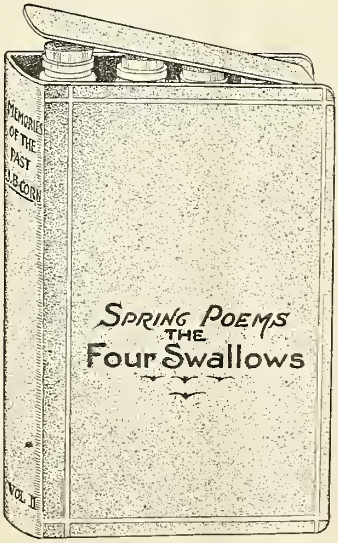

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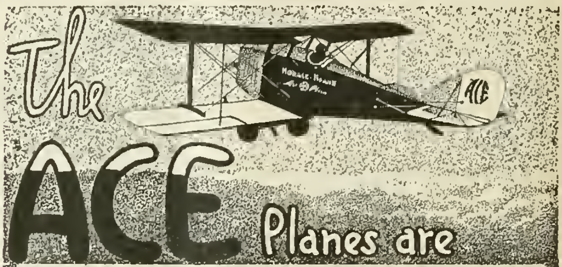

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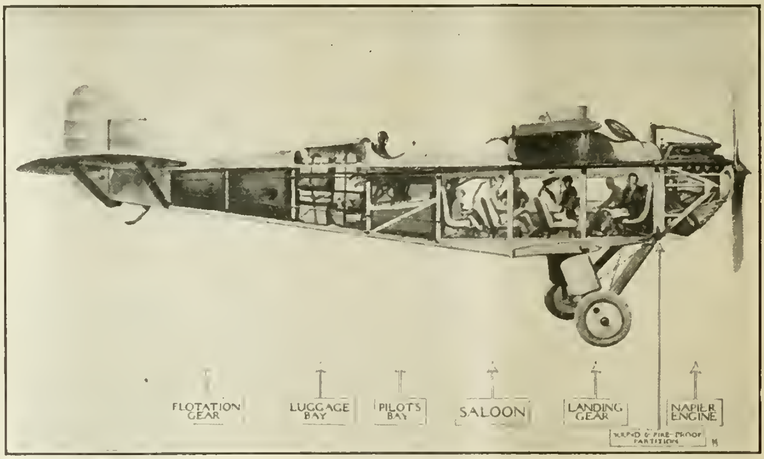

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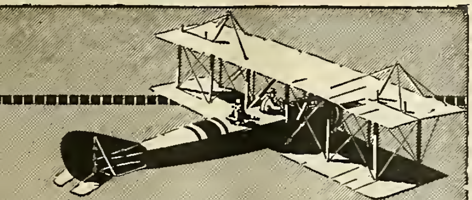

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AERONAUTIC BOOKS

Test Methods for Mechanical Fabrics

By George B. Haven, Associate Professor of Mechanical Engineering, Massachusetts Institute of Technology. Contents.—Aerodynamics. Wind Tunnels. Wings. Resistance. Estimation of Performance. Stress Analysis (by Prof. Howard B. Luther, of Massachusetts Institute of Technology). Weight Estimation. Airscrews. Motors. Materials of Construction. [Wiley.]

Principles of Airplane Design

By George Marshall Denkinger, Research Aeronautical Engineer, Air Service, U. S. A., and Clarence Dean Hanscom, formerly Research Aeronautical Engineer, Air Service, U. S. A. (In preparation. Ready Spring, 1921.) Vol. I. Theoretical and Experimental Aerodynamics. Contents.—Aerodynamics. Wind Tunnels. Wings. Resistance. Vol. II. Applied Aerodynamics. Contents.—Estimation of Performance. Stress Analysis. Weight Estimation. Air Screws. Motors. Materials of Construction. [Wiley.]

Aeronautics—A Class Text

By Edwin Bidwell Wilson, Ph.D., Professor of Mathematical Physics in the Massachusetts Institute of Technology. 265 pages. 6 by 9. 31 figures. Cloth. Postpaid $4.25.

Covers those portions of dynamics, both rigid and fluid, which are fundamental in aeronautical engineering. It presupposes some knowledge of calculus. The book will prove stimulating to other than technical students of aeronautical engineering. Contents.—Introduction. Mathematical Preliminaries. The Pressure On a Plane. The Skeleton Airplane. Rigid Mechanics. Motion in a Resisting Medium. Harmonic Motion. Motion in Two Dimensions. Motion in Three Dimensions. Stability of the Airplane. Fluid Mechanics. Motion Along a Tube. Planar Motion. Theory of Dimensions. Forces On An Airplane. Stream Function, Velocity Potential. Motion of a Body in a Liquid. Motion in Three Dimensions. Index. [Wiley.]

The Dynamics of the Airplane

By K. P. Williams, Ph.D., Associate Professor of Mathematics, Indiana University. (No. 21 of Mathematical Monographs, Edited by Mansfield Merriman and Robert S. Woodward.) 138 pages. 6 by 9. 50 figures. Cloth. Postpaid $2.75.

An introduction to the dynamical problems connected with the motion of an aeroplane, for the student of mathematics or physics. While not written for the person interested mainly with design and construction, most of the questions treated have some interest for anyone who is familiar with the entire field of aeronautics. The development of the French writers is followed more closely than that of the English and American, the author believing that it is worth while to make a treatment of this general sort accessible to American students of mathematics. Contents.—The Plane and Cambered Surface. Straight Horizontal Flight. Descent and Ascent. Circular Flight: 1. Horizontal Turns. 2. Circular Descent. The Propeller. Performance: 1. Ceiling. 2. Radius of Action. Stability and Controllability: Longitudinal Stability. Stability in Rolling. Lateral Stability. [Wiley.]

Learning to Fly in the U. S. Army

By E. N. Fales. 180 pages. 5 x 7. Illustrated. Postpaid $1.75.

In this book are set forth the main principles of flying which the aviator must know in order properly to understand his aeroplane, to keep it trued up, and to operate it in cross country flight as well as at the flying field. The material presented is all standard information, previously available to students only in fragmentary form, but not up to this time collected and arranged in logical order for study and quick reference. Contents.—I. History of Aviation. II. Types of Military Airplanes and Uses. III. Principles of Flight. IV. Flying the Airplane. V. Cross-Country Flying. VI. The Rigging of Airplanes—Nomenclature. VII. Materials of Construction. VIII. Erecting Airplanes. IX. Truing Up the Fuselage. X. Handling of Airplanes in the Field and At the Bases Previous to and After Flights. XI. Inspection of Airplanes. [McGraw.]

Aircraft Mechanics Handbook

By Fred H. Colvin, Editor of American Machinist. 402 pages. 5 by 7. 193 illustrations. Postpaid $4.25. New Edition.

A book specifically for the aircraft mechanic. During the war it was extensively used as a textbook in the U. S. Navy Training Stations, the Army Flying Fields and Schools of Military Aeronautics. It covers briefly the principles of construction, and gives in detail methods of erecting and adjusting the plane. The book is especially complete on the care and repair of motors. Descriptions of the various types of military aeroplanes and engines are given. The photographs and cuts show the principles and practice of adjustment and operation. [McGraw.]

Airplane Design and Construction

By Ottorino Pomilio. 403 pages. 6 by 9. Illustrated. Postpaid $5.25.

This was the first book to be published in this country which presents in detail the application of aerodynamic research to practical aeroplane design and construction. Although the feat of flying in a heavier than air machine was first accomplished in America, the major part of experimental work in aerodynamics has been conducted in Europe. The Pomilios of Italy have had an important part in this experimental work. The data presented in this book should enable designers and manufacturers to save both time and expense. The arrangement, presentation of subject matter, and explanation of the derivation of working formulae together with the assumptions upon which they are based and consequently their limitations, are such that the book should be indispensable to the practical designer and to the student. [McGraw.]

Radio Engineering Principles

By Henri Lauer, formerly Lieutenant, Signal Corps, U. S. A., Assistant in the Preparation of Training Literature on Radio Theory and Equipment, and Harry L. Brown, formerly Captain, Signal Corps, U. S. A., in charge of the Preparation of the Technical Training Literature used in the Signal Service. 304 pages. 6 by 9. 250 illustrations. Postpaid $3.75.

This is the first book to bring the science of radio up to date—to include the wonderful developments made during the war. In no other book published in this country is there such complete information on vacuum tubes. About one-half of Lauer and Brown's "Radio Engineering Principles" is devoted to the discussion of the three-electrode vacuum tube, taking up its use as detector, amplifier, oscillator and modulator. The book covers thoroughly the operation and characteristics of two- and three-electrode vacuum tubes, the practical applications of the tubes, the generation and control of electron flow, and the conditions which must obtain to cause a tube to operate in any of its functions. Aeroplane and submarine radio theory is discussed in detail. Other special applications of the vacuum tube are also treated. Lauer and Brown's "Radio Engineering Principles" is the authoritative modern textbook on the subject. [McGraw.]

Standard Handbook for Electrical Engineers

Frank F. Fowle, Editor-in-Chief, assisted by over sixty leading specialists. 25 thumb-indexed sections. 2000 pages. 4 by 7. Flexible. Illustrated. Postpaid $7.40 net.

The "Standard" is the most widely-used electrical book in the world. It is quoted everywhere as the final authority on electrical engineering. It has been endorsed by the leading electrical journals here and abroad. It is an encyclopedia of electrical engineering. Its twenty-five thoroughly indexed sections cover every phase of the subject. The book is the work of more than sixty of the world's foremost electrical engineers. It has been called a triumph of engineering cooperation because of its completeness, its reliability, and its get-at-ableness. [McGraw.]

The Aeroplane Speaks

By H. Barber, A. F. Ae. S. (Captain, Royal Flying Corps). Postpaid $3.25.

Captain Barber, whose experience in designing, building and flying aeroplanes extends over a period of eight years, has written this book to be of assistance to the pilot and his aids. Lucid and well illustrated chapters on flight, stability and control, rigging, propellers and maintenance are followed by a glossary of aeronautical terms and thirty-five plates illustrating the various types of aeroplanes and their development from the first practical flying machine. An introduction presents, in the form of conversations between the various parts of the aeroplane, a simple explanation of the principles of flight, written, says the author, "to help the ordinary man to understand the aeroplane and the joys and troubles of its pilot." [McBride.]

Aeroplane Design

By F. S. Barnwell. With a Simple Explanation of Inherent Stability—By W. H. Sayers. With diagrams. Postpaid $1.10.

Mr. Barnwell, who is well known as a highly successful designer, holds a commission in the Royal Flying Corps. The section of this book written by him formed a treatise read before the Engineering Society of Glasgow University. Mr. W. H. Sayers in the second part of the volume elucidates a problem that has been the occasion of much discussion among mathematicians—that of inherent stability. Both sections are fully illustrated by diagrams. This book has been adopted by the U. S. Government as a text book for the instruction of aviators. [McBride.]

Aerobatics

By Horatio Barber, A. F. Ae. S. With 29 half-tone plates showing the principal evolutions. Postpaid $3.50.

This book by Captain Barber, whose earlier work, "The Aeroplane Speaks", is recognized as the standard textbook on ground work and the theory of flight, is an explanation in simple form, and for the benefit of the student, of the general rules governing elementary and advanced flying. Part I, which is headed "Elementary Flying", is an explanation of the essential elements of flight instruction from the moment the student enters the machine until he becomes a finished pilot. The mechanical control of the machine, straight flying, turns of all kinds, stalling, diving, gliding, slide-slips, and various ways of landing, flying through clouds, "taxying" and the first solo flight are described and analyzed fully and in non-technical language, each subject being taken up in progressive order. Part II explains the more advanced evolutions such as looping, spinning, the half roll, the complete roll, the Immelman turn, the falling leaf, the cart wheel, etc. The book contains a progressive syllabus of instruction, a glossary of technical terms and numerous advisory hints. [McBride.]

Flying Guide and Log Book

By Bruce Eytinge. With a Foreword by H. M. Hickam, Major, Air Service. 1921 edition, enlarged and revised to date. 150 pages. 4¾ by 7¼. 38 illustrations, including many photographs of landing fields, and a 24-page Pilot's Log Book for Machine, Motor and Flying. Cloth. Postpaid $2.75.

This book contains valuable information for the aviator, and also, for all those who are interested in, and helping to develop, commercial aviation. Contents.—Calendar. Identification. Frontispiece. Foreword. Past and Present (Poem). Introduction. Don'ts. Helpful Hints. Landing Field Report (Questionnaire). Airdromes—Landing Fields. War Department Orders: Specifications for Municipal Landing Fields. General Flying Rules to Be Observed At All U. S. Flying Fields. Cross-Country Flight Regulations. Rules of the Air. Flying Certificates for Pilots. Trouble Shooting in Airplane Engines. America's Aviation Facilities—Landing Fields (Alphabetically Listed Under Each State). Trans-Continental Aerial Mail Route. Air Routes (Round the Rim Flight). Pilot's Log Book for Machine, Motor and Flying. [Wiley.]

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Ansaldo Curtiss Balilla.

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AERIAL AGE WEEKLY

OL. 14. No. 12 NOVEMBER 28, 1921 10 CENTS A COPY

Airscape of Valley Forge, Pennsylvania, One of America's Famous Battlegrounds.
Photographed by the Aero Service Corporation, Philadelphia

The Fallacy of the Slotted Wing—The Choice of A Wind Tunnel—The Curtiss CD-12 Engine

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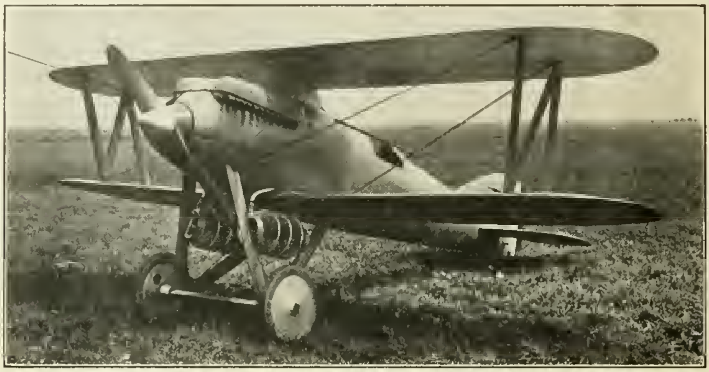

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LEGION FREE-FOR-ALL—Lloyd Bertaud in "K-12 BALILLA."
PULITZER TROPHY RACE—Bert Acosta in "CURTISS NAVY RACER."
OMAHA 90-MILE RACE—Casey Jones in "C-6 ORIOLE."
OMAHA 75-MILE RACE—F. A. Donaldson in "OX-5 ORIOLE."

"CURTISS" Seconds—PULITZER TROPHY RACE—Clarence Coombs in "CURTISS COX RACER."
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THE FALLACY OF THE SLOTTED WING

THE past year has seen the development of a number of devices and methods for increasing the lifting power of wings. The most notable of these are the Handley-Page slotted wing, the Martin leading and trailing edge wing flaps, and the Dayton-Wright split trailing edge. It is difficult to decide which of these developments possesses the most merit. The Handley-Page slotted wing is based upon more extensive tests and has been subjected to more critical study than the other devices. It is undoubtedly possible to secure a much higher lift with two or three slots parallel to the leading edge than by any other known method. It is recognized, of course, that all of these devices are in the experimental stage. Only the Handley-Page has been tried in a full scale model in flight, and that was a rather crude attempt. All the mechanisms necessary for the operation of the different arrangements must be developed. From this point of view the Martin flaps offer the least encouragement, since with them large sections of the wing, especially the leading edge where the air forces are greatest, must be moved through a considerable angle, the forces or stresses in the controlling mechanism must be very large. On the other hand, if the upper end of the Handley-Page slots can be closed by a sort of balanced valve, the possibility of successfully working out the mechanism seems good.

There is another side to this important question, however, which hitherto has not been discussed. Suppose for the moment that Mr. Handley-Page's wing were perfected so that the lift were doubled or trebled, and also assume that the weight of the operating mechanism was not excessive, and even that this mechanism functioned perfectly. Does it necessarily follow that such a wing would revolutionize aeroplane standards? All of the engineers working on this problem of very high lift wings would answer "yes." Mr. Handley-Page believes so.

Why would not Handley-Page's invention be of the utmost value if it would work successfully? Have not engineers always striven for wings with higher and higher lift and, of course, a reasonable efficiency? This is so, yet Mr. Handley-Page's invention will by no means have a universal application. On military types it would have but little practical value, and indeed, if by means of it the wing area were reduced to give the landing speeds that are found to be satisfactory at the present time, it would be a serious detriment to the efficiency of the design. The factor which has been forgotten, or deliberately neglected, is the effect of reducing the wing area on what has been termed the "fineness," or cleanness of an aeroplane, as this conception has been developed by Mr. Kerber.

"Fineness" is just as important in determining aeroplane performance as pounds per horsepower or pounds per square foot. It is determined by the ratio of the wing area to the equivalent flat-plate area of an aeroplane. By the latter term is meant the area of a flat-plate which would have a resistance equivalent to the resistance of the chassis, struts, wires, fuselage and empennage. For instance, a standard DH-4 with 440 sq. ft. of wing area has a fineness of 100. With areas 50, 75, 100, 125, and 150 per cent of this area the finenesses become 85, 93.5, 100, 107, and 112 respectively. The speed, due to the greater wing loading, of course, becomes somewhat higher as the area is decreased. Were the fineness to remain constant the speeds with the above areas would be 152, 134, 122.5, 113.5 and 107, but owing to the altered finenesses, the true speeds are 127, 125, 122.5, 121, and 119 M.P.H. The effect on speed of decreased fineness, due to reduced wing area, is serious. It greatly lessens the only advantage given by smaller wing area. The very serious disadvantage of high wing load is its effect on rate of climb and ceiling. With constant fineness these flight characteristics fall off rather rapidly with increase in wing loading, and when the effect of lowered fineness is also taken into account the full penalty for reducing wing area is brought out. Taking the same wing areas as before, the corresponding rates of climb are 635, 880, 990, 1000, 1120 F.P.M. and the service ceiling 8700, 14200, 17200, 19200 and 20600 ft. Such a comparison makes clear the loss in performance due to reducing wing area, and the advantage gained in increasing it.

The weight of the DH-4 with 440 sq. ft. was taken at 3800 lbs. In varying the wing area, allowance was made for the variation in the weight of the wings, by assuming that the weight per sq. ft. remained a constant which has been shown to be very nearly correct.

On practically all military types, rate of climb and service ceiling are of the greatest importance. They are the factors which determine the maneuverability of an aeroplane. High speed is of no value unless it is accompanied by good climb and ceiling. In aeroplanes intended for ground attack or low observation, where ceiling is not important, a fairly high rate of climb is still necessary in taking off and getting out of the restricted fields of front line airdomes. Low wing loading

(*Continued on page* 276)

THE NEWS OF THE WEEK

Aero Club Annual Meeting

The twelfth annual meeting of the Aero Club of America was held on Monday evening, November 14, 1921. The following Governors were elected under Class A, term expiring 1924: James A. Blair, Jr., George H. Houston, Richard F. Hoyt, Herbert Fish, S. R. Bertron and Lorillard Spencer. The following Governors were elected for one year, under Class B: Godfrey L. Cabot, Howard E. Coffin, Rear Admiral B. A. Fiske, Charles J. Biddle, Albert Bond Lambert, George M. Myers, John Larkin, Benedict Crowell, Gould Dietz. The officers to serve for the coming year will be elected at the next meeting of the Governing Board.

Marshal Ferdinand Foch, Admiral Sir David Beatty and General Armando Diaz were elected honorary members.

Reports of the various committees were read, including the Contest Committee, which announced the various meets that had been sanctioned throughout the year and strongly advocated aviation competition which has done more than any other one thing to develop real progress in the building of new types of machines and increasing the skill of pilots.

A very interesting report from Mr. Godfrey L. Cabot, delegate of the Aero Club of America to the F. A. I. conference in Madrid, was read in which he stated the Congress was opened by the King and Queen of Spain with impressive ceremonies. The Aero Clubs of China and Chile were elected to membership, and Austria was reinstated as a member of the F. A. I. World's records for spherical balloons of different sizes were provided for to increase interest in free ballooning.

The rules were modified in the case of altitude records for aeroplanes permitting them to land at some other place than the point of departure provided the instruments were returned intact and duly sealed.

A form of Triptyque was adopted which will do away with many of the difficuities now encountered in passing across the border from one country to another and complying with the customs regulations. By registering aeroplanes with their club it becomes responsible for the duties and vouches for the return of aeroplanes crossing the frontier. This is similar to the arrangement made by the automobile clubs of Europe to enable their members to cross the frontier without being delayed by tedious formalities. The request by America to have hydroplane records classified separately was adopted and referred to the Technical Committee to determine the various details involved. The committee will meet in January to fix the date for the next meeting in 1922.

A vote of thanks was tendered to the Foreign Service Committee for their good work in representing the Aero Club of America at the various meets and conferences held in Europe during the past year, including the Gordon Bennett Aviation and Balloon Races and the Deutsch de la Meurthe speed prize contest.

Resolutions were adopted commending the work and the recent achievements of the Army and Navy in demonstrating the efficiency of the aeroplane as agency of the national defense.

Annual Meeting, A. N. A. S. A.

Pursuant to notices sent to all members of the Army and Navy Air Service Association the annual meeting for election of officers and members of the Board of Control and for action on proposed revisions in the constitution and by-laws, mentioned in the notices which were sent to all members in August, was held in the Trophy Room of the office of the Chief of Air Service, Munitions Building, Washington, D. C., at 4.30 o'clock p. m., on October 3, 1921. There were present by proxies and in person votes in excess of 50 per cent of the membership of the Association. The following officers and Board Members were elected for the terms specified below and the revisions to the Constitution which had been submitted to the membership were adopted. A copy of these revisions will be sent to any member or other person who may be interested.

President (for term expiring October, 1922): Major-General Charles T. Menoher, U. S. Army.

First Vice-President (for term expiring October, 1922): Rear-Admiral W. A. Moffett, U. S. Navy.

Second Vice-President (for term expiring October, 1922): Brigadier-General William Mitchell, U. S. Army.

Third Vice-President (for term expiring October, 1922): Lieutenant-Colonel A. L. Fuller, U. S. Army.

Fourth Vice-President (for term expiring October, 1922): Commander Kenneth Whiting, U. S. Navy.

Secretary (for term expiring October, 1922): Earl N. Findley, formerly captain, A. S. A.

Assistant Secretary (for term expiring October, 1922): 1st Lieutenant W. E. Connolly, U. S. Army.

Treasurer (for term expiring October, 1922): Lieutenant-Colonel W. E. Gillmore, U. S. Army.

Assistant Treasurer (for term expiring October, 1922): Commander P. N. L. Bellinger, U. S. Navy.

Chairman of the Board of Control (for term expiring October, 1922): Major T. C. Turner, U. S. M. C.

Members of Board of Control (for term expiring October, 1922): Commander John H. Towers, U. S. Navy; Lieutenant-Colonel J. E. Fechet, U. S. Army; Horace Green, Major, R. C.; A. B. Lambert, formerly major, A. S. A.

Members of Board of Control (for term expiring October, 1923): Commander V. K. Coman, U. S. Navy; H. E. Hartney, formerly lieutenant-colonel, A. S. A.; Major W. G. Kilner, U. S. Army; Maurice G. Cleary, formerly captain, A. S. A.

Members of Board of Control (for term expiring October, 1924): B. F. Castle, formerly lieutenant-colonel, A. S. A.; Major H. M. Hickam, U. S. Army; Major Oscar Westover, U. S. Army; A. J. Ely, Major R. C.

Predicts Day's Trip Around the World

Paris.—The first International Congress of Aerial Navigation opened November 15 in connection with the Aeronautical Salon in the Grand Palais, twenty-six countries being represented. Eight questions will be examined by the congress—five concerning the present technical conditions of aeroplanes and three regarding navigation by air. The latter will, it is hoped, lead to the establishment of standard international rules governing transport by air.

The presence of Fokker, the famous inventor, at the salon, where he is exhibiting his latest type of aeroplane, is arousing much bitter comment in Paris. Fokker's association with Germany during the war is not forgotten or forgiven, and the fact that he has again become a Dutch citizen does not prevent the French from asking that he be requested to abstain from appearing on the occasion of the official visit of President Millerand to the exposition.

The celebrated aeroplane designer, Breuget, addressing a meeting of French scientists, said he had plans for building an aeroplane which would be able to fly from Paris to Buenos Aires in three days, making only five stops on the way. The cost of the journey, he said, would roughly, correspond with that of a first-class passage today on an ocean liner. The machine, which M. Breuget expects to produce before many years have elapsed, will have, he says, 1,200 horse power and a speed of 253 kilometers an hour, and will weigh twelve or thirteen tons. It will carry twenty passengers, one ton of baggage, a crew of seven and four tons of gasoline.

Continuing his address, M. Breuget traced the future development of flying at high altiudes with the turbo-compressor invented by Rateau, which enables engines to maintain their power in rarefied air. Basing his arguments on strict mathematical calculations, M. Breuget told of an aeroplane which, leaving Paris and flying at an altitude of 12,000 meters, would fly completely around the earth and return to Paris twenty-four hours later. The ultimate speed of machines flying at this height, he said, would be 800 meters per second, which is faster than that of an artillery projectile.

Air Control at Sea Vital

Discussing the development of the fighters of the air before the Society of Naval Architects and Marine Engineers, at its annual meeting in New York City, Mason S. Chace, naval architect of Boston, asserted that the navies of the world were now face to face with the necessity of developing aerial means of offense and defense.

"I believe the supreme position of the battleship is more threatened today than it has ever been, if that position is not already lost," he said. "On the supposition that a small number of the largest bombs carried by aeroplanes can destroy a battleship, we may conclude that in the naval battles of the future victory will go to the forces which control the air."

Congress Asked to Accept Rockaway Station

Washington.—Authority to accept from the City of New York, without expense to the Federal Government, the site of the naval aviation station at Rockaway Beach was requested of Congress November 17 by Secretary Denby.

The tract comprises ninety-four acres, and on it are hangars, shops, storehouses and barracks, which, Mr. Denby said, would be of little value if the station were permanently abandoned.

Aid Ecuador's Aviation

Washington.—France and Italy have entered into an agreement with Ecuador with the object of organizing and developing that country's military, maritime, postal and commercial aviation, the Department of Commerce was advised November 17 in a consular report from Guyaquil.

The agreement provides for the establishment of aviation missions in Ecuador to aid in the development of aviation.

The AIRCRAFT TRADE REVIEW

American Airways Activities

Mr. Augustus Post, recording secretary of the Aero Club of America and pioneer aeronaut, and Major Baldwin, U. S. Inspector of Lighter-Than-Air Craft at Akron, Ohio, inspected the School of the American Airways at College Point, L. I., on November 16th.

Mr. Post gave a lecture on the Performance and Future of Aviation. Major Baldwin spoke on his work, which has been quite extensive.

On the 18th Mr. Ralph Upson gave an illustrated lecture on lighter-than-air craft at the American Airways School before the men taking the course in Aeroplane Mechanics.

Mr. Henri Francimont, foreign expert and formerly Curtiss' wind-tunnel authority, has been added to the faculty of the school, being in charge of technical subjects.

C. L. Maguire Company's Text Book

The C. L. Maguire Text Book of Aeronautical Lubrication is found to be of intense interest and value to the industry. Besides containing information of general kind the book includes charts and statistics relating to aeronautic engines. It outlines the conditions that arise in the development of motor trouble in the engines, describing in detail the cause, the effect and the remedies. This book has been prepared with the assistance of various experts of McCook Field, lubricating expert engineers of St. Louis and Washington.

"Jersey Road" to Philadelphia, Washington and the South

We are indebted to G. S. Ireland of the Curtiss Eastern Airplane Corporation for the following information:

"We thought your readers would be interested to know what is known as the 'Jersey Road' to Philadelphia, Washington and the South, starting from Mineola. This air route, we believe, is far better than the old one which mail pilots and army flyers use, such as picking up the Pennsylvania Railroad at Jersey City, crossing the Delaware at Trenton into the State of Pennsylvania and following the Delaware River to Philadelphia.

"You start at Mineola, flying in a due southwest course, picking up a course half way between the town of Freehold, N. J., and the old Pennsylvania Railroad tracks, coming to Bordentown, passing Camp Dix on the left and Mount Holly, N. J., on the right, flying straight over Medford, N. J., until you pick up the first railroad, which is the Pennsylvania line, between Camden and Atlantic City. Before you come to the Reading Railroad to Atlantic City, you will see the Curtiss Flying Field, which can easily be picked up by the two white hangars and green roofs and the word CURTISS printed in large letters on the roof. This field is a four-way field and consists of 100 acres, adjacent to other fields which can be used for emergency landings.

"To continue your route to Washington, you should head straight for Glassboro, which is the next railroad crossing, then for the Delaware River, crossing the river below Salem and picking up the Canal which runs into the Chesapeake Bay and then following the old route to Baltimore and Washington.

"The advantages of this route we find are due to the fields which have supplies and give service such as the Aeromarine Field at Keyport, Camp Dix and our field at Pine Valley. It is also shorter and its great advantage is the fact that you can always find an emergency field to land anywhere between Mineola and Pine Valley in case of a forced landing. The Curtiss Field at Pine Valley is the nearest large field to Philadelphia and has telephone, train, trolley and good road facilities to Philadelphia. It is a four-way field and is not surrounded by any obstacles which cannot be seen from the air, such as transmission wires and fences. Such machines as the Curtiss Eagle, the Junker and the Foker use our field when wishing to reach Philadelphia."

A New Map of Universal Interest

A new base map of the North Pacific Ocean on the transverse polyconic projection has been prepared by W. E. Johnson, Cartographer of the U. S. Coast and Geodetic Survey of the Department of Commerce, and is now available for distribution. It is published in clear form and convenient size (dimensions 14 by 41 inches) for desk use. (Map No. 3080, North Pacific Ocean, scale 1:20,000,000, price 25 cents.)

This map is designed primarily as a base on which statistical data of various special kinds may be shown. In consequence of this purpose only features of major importance are shown on it and these features are emphasized to an extent not possible on a map which contains the vast amount of detail usually included.

In addition to the foregoing specific value this map is of general interest at present as showing the relation between the United States, its possessions, and the Far East and as including those areas around which present problems in the North Pacific Ocean are centered.

This map represents the acme of scientific precision combined with simple practical utility. It extends from New York and Panama to Singapore and Calcutta, from Alaska and Siberia to the Hawaiian Islands and includes a part of South America and a portion of Australia. Through its lateral center it extends over 180°, or more than half way around the earth.

The distinctive feature of the map is that these localities are here pictured in practically their true relation as to distances, areas, and comparative angular direction of coast line. It will thus serve to correct the erroneous impression that we have all received from the usual representation of this region on Mercator charts and maps which greatly exaggerate areas and distances toward the poles when compared with their equatorial equivalents, and to the eye present the general continental coast lines out of their proper angular relation to one another. This is not a criticism of the Mercator projection for use in navigation, but merely of its use for purposes for which it is not adapted. In fact, if the Mercator projection were transversed just as the polyconic has been, the result would be only slightly different.

The problem of representing any considerable portion of the ellipsoidal form of the earth on a plane surface is not readily dealt with, or, in other words, is intractable. Always some desirable features must be sacrificed in order to incorporate those of primary value to the problem or area at hand. In the present instance, the property of true scale along a great circle tangent to the forty-fifty parallel of north latitude at the central meridian of the map was chosen. This great circle is approximately the shortest distance between San Francisco and Manila, and in close proximity to it lie practically all the important points of interest, such as the Panama Canal, Mexico, our Pacific Coast, Alaska, the Philippine Islands, Japan, and the coast of China. This is accomplished through the use of the transverse polyconic projection, which is the regular polyconic or American projection turned from its normal vertical axis to a lateral great circle axis. This is an involved and laborious operation, but the resulting advantages are well worth while where areas of this nature are presented and accuracy is desired.

Both the vertical and lateral axes are straight lines, true to scale, and represent the shortest distance (great circle) between their extreme points. From these central lines the scale gradually expands toward the corners of the sheet where the maximum error occurs, thus quite a wide band of small scale error is preserved through the lateral center wherein lie the majority of the important cities, commercial areas and trade routes of this region.

This system of projection was devised by Ferdinand Hassler, who was the organizer and first superintendent of the oldest scientific government bureau, the U. S. Coast and Geodetic Survey. This projection was computed and constructed by C. H. Deetz, Cartographer, U. S. Coast and Geodetic Survey.

Photographic Forest Survey

The 15th Aerial Photo Section, located at Crissy Field, Presidio of San Francisco, California, made a photographic survey recently covering the district between Fort Bragg, California, Montague, Calif., and Mather Field, Sacramento, Calif. This survey is to furnish data regarding the value of the forest patrol operations during the past summer.

THE CHOICE OF A WING TUNNEL

Second Installment of a Series of Wind Tunnel Articles "The Universities and Aerodynamics"

By E. N. FALES and F. W. CALDWELL

(Continued from last week)

IN establishing a Wind Tunnel Laboratory we must choose between the various forms in which such a plant may be built. All Wind Tunnel Laboratories are not alike nor indeed will the results from one always check those from the others, but the exponent of each holds for his own type. It is therefore the purpose of this article to itemize the characteristics fundamental in precise wind tunnel work, and with these as standard, to analyze the features of each type; toward the end that choice may be made, according as particular facilities or needs shall stipulate.

Desirable Characteristics: The object of a wind tunnel is to produce the empirical data upon which the science of aeronautics depends. Hence a wind tunnel must first of all be able to produce reliable results. The degree to which this aim is attained, with reasonable facility and economy of operation, will be found dependent upon the characteristics analyzed in the list below.

First Cost: At the head of the list we are obliged to put first cost, and ease of construction; and to consider whether, other things being equal, we get precise results more cheaply with an N. P. L., an Eiffel or a Gottingen type tunnel. The question of cost is seriously affected by the power and the size of building; in general, a large or powerful tunnel costs more than a small tunnel, the building cost varying as the $(\text{diam})^3$ and power costs as the $(\text{velocity})^3$ and $(\text{diam})^2$.

Uniformity of Velocity in Cross-Section of the Air Stream: Since we are simulating ideal flight conditions, it is of high importance that each portion of the model under test shall receive the same air velocity. A good traverse of the cross-section is shown by the solid curve of Fig. 1; the dotted curve is for poor traverse, such for example as could be caused by air entering an N. P. L. tunnel at an angle. It is impossible to secure uniformity near the tunnel walls. Here there is energy loss known as skin friction, which we can best explain according to the theory that the air flow surrounds itself with cyclic formation analagous to smoke rings. These are like roller bearings, (albeit with much internal energy loss) for the translation of the main flow.

Freedom from Velocity Fluctuations: Gustiness in the tunnel is to be avoided. Gusts, like their larger prototype in terrestrial air flow, are an obscure phenomenon which are best attributed to pressure increments resulting from whirls. Their effect is especially marked when the flow is accelerated. To them we largely owe the capricious nature of all air flow. To realize this, one has but to witness a terrestrial water-spout or "twister" forming at the earth's surface where acceleration in upward rise occurs; or to observe the counterpart in a wind tunnel intake, by using suitable visualizing means. A small vortex gains energy rapidly as it enters the intake bell of a wind tunnel. Once created by irregularities in the path, or by internal causes such as spiral flow, it persists. It may be of local extent, with the result that when it meets the model under test its energy is released on a part, rather than uniformly on the whole model. That is, its effect cannot be balanced off against a symmetrical effect elsewhere in the stream.

Furthermore, our best means of determining velocity is by pressure record; there is a time lag between changes of velocity in the tunnel and manifestations thereof on the manometer, and in gusty conditions of high energy flow we find our balance readings out of step with the velocity head readings.

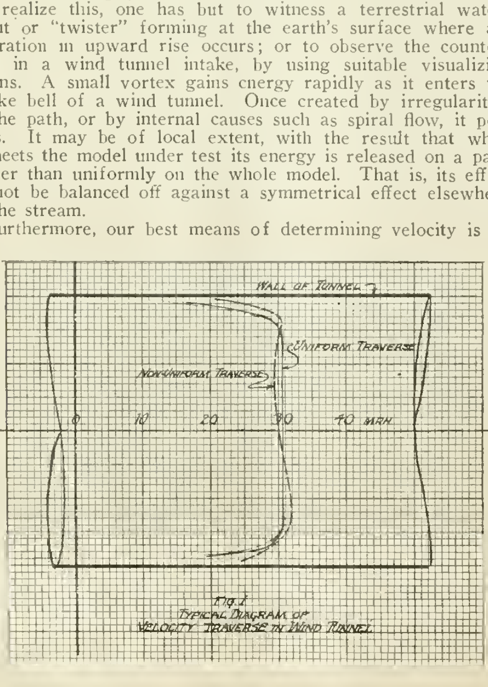


Fig. 1
Typical Diagram of Velocity Traverse in Wind Tunnel

Prevention rather than cure, is to be sought as regards "Gustiness"; and we here deal with what is perhaps the most important single item in attaining smooth air flow;—namely, the conditions of intake. The air prior to acceleration must be as nearly quiet as possible, and its path must be uniform and symmetrical. Various devices may be used to prevent the inception of whirls (the honeycomb, rectifier, straightener, etc.). Here also is the prime reason for using a large return flow area for the air, necessitating in the case of the N. P. L. type channels, a large building, toward the end that intake velocity may be low.

Freedom From R. P. M. Changes in the Fan: Change of fan speed, while slower and less harmful than changes due to gustiness, are nevertheless to be avoided; commercial ranges of ½% on the R. P. M. are about the limit, although new methods give promise of a lower figure. Any source power subject to variations of R. P. M. is to be avoided.

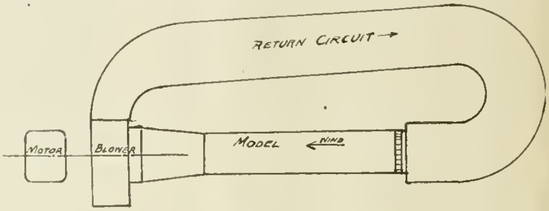


Fig. 2 Plan View of
Typical Closed Circuit Wind Tunnel

Rectilinear Air Flow: Air flow direction can now be measured to a small fraction of a degree; and in wind tunnels it is found to be not necessarily truly axial. Mr. Wright has observed that the angle may be one thing on starting up, and another later on after flow equilibrium in the room is acquired. Spiral flow is a form of non-rectilinear flow which must be avoided.

Convenience of Operation: Inasmuch as routine wind tunnel tests require a large number of successive readings, speed of operation is desirable. Labor-saving devices on the balance are particularly useful toward the end of reducing the personnel needed. Speed of reading the velocity pressure depends on the air flow conditions. Easy access is desirable for the purpose of installing, adjusting and removing the model.

Absence of Noise and Vibration: A wind tunnel involves much noise where the R. P. M. is high. In such case, conversation cannot be carried on and the discomfort is great. In common with aeroplane propellers, noise has been a subject of study; it can be decreased but hardly eliminated. Vibration depends upon the foundations used.

Economy af Power: This may be an important item, in large plants, or a minor item as in small plants. The present day tendency is towards large tunnels of good speed, and economy of power is important. The regenerative cone is the chief factor in economy; since this entails considerable

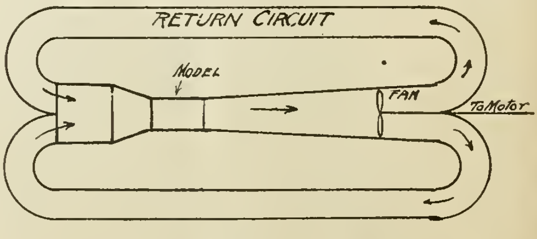
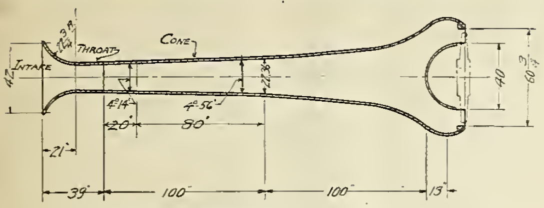


Fig. 3

Plan View of Typical Double Return
Closed Circuit Wind Tunnel



OUTLINE DIAGRAM OF
McCOOK FIELD VENTURI-TYPE WIND TUNNEL FIG. 4.
SHOWING CONE-PROPORTIONS

space, economy of power often means high cost of building.

Independence of Weather Conditions: The apparatus must not be subject to sudden changes of atmospheric pressure. So sensitive is air flow that an open door is sufficient for transfer of gust effect from outdoors into the tunnel; with the result that satisfactory results are hard to get. Outdoor tunnels therefore cannot be counted on for fine work more than two or three days per month, and while they may conceivably be attained in the future, we must await the development of improved automatic recording instruments.

Large Size of Blast and High Speed: The law of dynamic similarity makes it desirable to secure a product of speed and dimension as near as possible to the full scale values; although it is not practicable to reach the full scale value. Again, the high speed of propeller blades calls for high speed tunnels where propeller work is done. Large size of tunnel permits large models, which can be made more easily and tested more accurately than small ones. In general, large size is costly in building expense, large speed is costly in motor and electric current expense.

Space Required: The N. P. L. type tunnel requires comparatively large floor space, and high ceilings. An ideal housing would be formed as a cylinder with axis coincident with the tunnel; the return flow would then be truly symmetrical. In practice a desirable building has height substantially equal to width. The closed circuit tunnel can be installed in any space big enough to contain it.

Speed Range: While most routine tests in any tunnel are run at a given velocity, a wide range affords the advantage that we may study the speed effect on tests. Where alternating current motors are used to drive the fan, such range cannot well be had. Some methods of reading require a slight alteration of the speed sufficient to oscillate the balance for reading purposes.

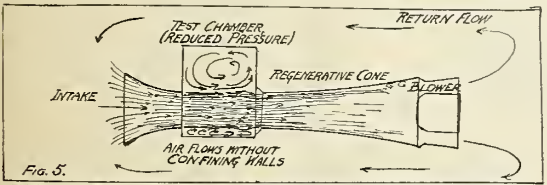

TEST CHAMBER (REDUCED PRESSURE)
RETURN FLOW
REGENERATIVE CONE
BLOWER
INTAKE
AIR FLOWS WITHOUT CONFINING WALLS

FIG. 5.

ELEVATION OF EIFFEL TYPE WIND TUNNEL, SHOWING INDUCED CIRCULATION IN TEST CHAMBER.

Suitability of Existing Tunnels for Attainment of Desirable Characteristics

Wind tunnel types fall under two classifications—(a) Closed Circuit and (b) Open Circuit. Fig. 2 is an example of the former. The closed circuit tunnel depicted was designed according to the principles of ventilating Engineering, in collaboration with a leading blower firm. The closed circuit has made its appeal largely on grounds borrowed from the older branches of engineering,—its primary idea being to avoid "discharge loss", to take the high speed flow after it has passed the model, and lead it by a return duct back to its point of original entry into the experimental chamber. Thus the kinetic energy was to be saved because the air at no point in its path was brought to rest.

As a matter of fact, purely from power consideration such a tunnel is inferior to the open circuit type, for in turning the corners or bends of the closed circuit, whirls and irregularities occur which absorb the energy otherwise to be salvaged, and the efficiency is very low. Furthermore, the whirls and irregularities resulting in such flow require special appliances and special care toward the end of eliminating undesirable effects in the air flow of the experimental chamber.

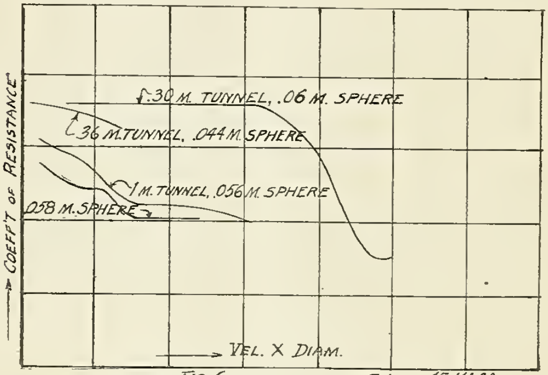


FIG. 6 Tech. Note. 45 N.A.C.A

DIAGRAM ILLUSTRATING
EFFECT OF SIMILAR TESTS IN DIFFERENT WIND TUNNELS.

The New Gottingen Tunnel: Dr. Prandtl reports good success with his new closed circuit tunnel as regards uniformity of air flow. One advantage is that the return circuit is under the floor, thus saving much space. Another advantage is that the experimental portion has a gap, across which the air flows; and the flow is thus of easy access, and is not separated by

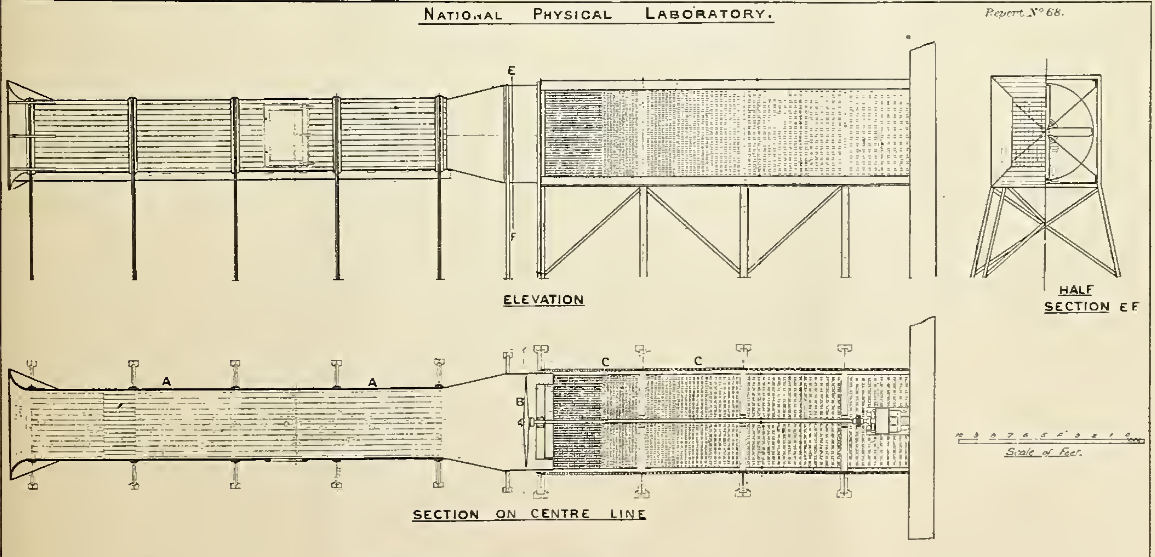


FIG. 7. FOUR FOOT WIND CHANNEL

doors, walls, or air-lock from the main laboratory. The efficiency, however, is not of the best—*32%*.

A more efficient form of closed circuit is that used by Orocco in Italy (Fig. 3). It has a symmetrical double return circuit, wherefore the air flow is easier to straighten out. Its efficiency is good (65%) because the air is decelerated in a regenerative cone before entering the return circuit.

The open circuit tunnel at present attains the highest known efficiency, *i. e.* 76% in the case of the McCook Field Wind Tunnel. (See Fig. 4.) Such a tunnel is analagous to the Venturi tube of the Hydraulic Engineer, where high velocity at the throat is attained without high velocity of discharge. After passing the throat the air stream slowly expands and decelerates in a suitable cone, until the greater part of the kinetic energy is converted into pressure, and velocity of discharge is low. Thence the air flows back through the wind tunnel building with velocity not at all formidable and reenters the intake. In effect it is a closed circuit wherein the return flow entirely surrounds the tunnel and has relatively great cross-sectional area.

Eiffel Tunnel: This type has been popular because it affords easy access to the air current. The tube has a gap surrounded by an airtight chamber of some considerable size. After once the operator enters this chamber through an airlock, there are no further barriers to the introduction of models directly into the air stream. In Fig. (6) it is seen, however, that the gap causes secondary circulation inside the experimental chamber. This absorbs power and at high speed annoys the operator.

The N. P. L. (National Physical Laboratory) Type: This type has the advantage of good velocity traverse and smooth flow and is capable of high efficiency (although the N. P. L. tunnels themselves have low efficiency the regenerative cone principle not being adequately applied, they reach but 1/20th the efficiency attainable). A disadvantage of the N. P. L. type, which it shares in common with the Eiffel, is that for precise results a large building is required.

Rateau Tunnel: The Rateau type of tunnel may be mentioned sufficiently to note its defects. It consists of a jet of air blown from a nozzle into an open room; models are then tested in the jet. First of all, such a jet with difficulty can be smoothed out. Second, it has a longitudinal velocity gradient due to its deceleration. At the same time its cross-section enlarges and the streamline of such a jet has no directional uniformity.

Recommendation

In point of number the N. P. L. type leads, with the Eiffel a close second, and the closed circuit last (of the latter there exists one each in the United States, Germany and Italy). The closed circuit type may be eliminated from our consideration unless we are cramped for space, and even so, we ought to await further reports from Dr. Prandtl as regards the air flow steadiness of his new tunnel. The Eiffel type may be eliminated if we are willing to forego ease of access to the model, and are willing to shut down the fan every time we wish to touch the model.

There remains the N. P. L. type. Discounting the tendency of English speaking people to prefer this English-made tunnel, this type does nevertheless more nearly afford conditions of ideal air flow,—a straight line flow in a Venturi-like channel having continuous walls and symmetrical proportions. It is in the N. P. L. type of tunnel that we can, after suitable developments in the design, best realize the principles of air flow which are slowly gaining recognition as aeronautical study advances.

Recent analysis of air flow dynamics points to the importance of matters which in earlier days have escaped attention,—*i. e. slight* spin of the flowing stream, angular deviation, bad entrance conditions, etc. Those discrepancies which exist as between the results of one and another laboratory (exemplified in Fig. 6) are to be attributed to the character of the respective air flows, or to the methods of recording velocity pressures.

It is the character of the air flow, which determines the limiting precision of a wind tunnel; no case exists elsewhere in engineering where smooth flow must be so carefully sought as here. The chief problem in precision lies in recording velocity rather than in measuring the forces on the balance.

Thus, in considering types suitable for precise work, we must make uniformity and steadiness, *i. e.* smoothness of air flow the first requisite. Convenience, efficiency and even expense are subsidiary.

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The October meeting of the Club was held at the rooms of the Club, 1026 Walnut street, Philadelphia. A large attendance of the members was noted. A dinner was tendered Mr. Joseph A. Steinmetz, president of the Club, who lately returned from an extensive European trip, during which he visited all the important air ports of France and England. Just previous to the business meeting of the Club the members were privileged to view the wonderful collection of air mail stamps which Mr. Steinmetz has been collecting for years. The collection dates back from the balloon letters which were sent out of Paris during the great siege of 1870 and included in the collection are stamps of the Hawker attempted Trans-Atlantic flight and the more successful one of Alcock-Brown. Undoubtedly it is one of the finest collections of air-mail stamps in the world.

An experiment which met wtih complete success attended the catapulted launching of a two-seated seaplane at the Philadelphia Navy Yard on October 31st. The plane was launched at a speed of 48 miles per hour and piloted by Captain H. C. Richardson, who was in command of the NC-3 when it started with the other NC's in their historical flight across the Atlantic. The catapult consists of a grooved track, fifty feet long, in which a cradle is fitted, with flanges on the side and bottom working in the groove.

The cradle bearing the plane is pulled from a dead stop to full speed by an endless cable which works on pulleys under the track. The cradle is stopped at the outer end by a bumper. When the cradle reaches the end of the track, the plane which it bears is hurled into the air. The development of the catapult to this point is the result of the bombing tests made this summer. By equipping the battleships with catapults, each vessel can, at the approach of a fleet of hostile planes, launch its own aircraft to fight off the enemy.

The Navy has requested Congress for ships with flush decks on which wheeled planes can make a landing, but points out that until these are constructed, battleships equipped with catapults can launch seaplanes, which will make their landing on the water and be hauled back to the deck.

Among those who witnessed the experiment were Captain Louis McCoy Nulton, Commandant at the Yard; Commander Westervelt, in charge of the Naval Aircraft Factory; and other high naval officials and scientists interested in the latest achievements in aeronautics.

During the latter part of November an all-metal seaplane was demonstrated at the Philadelphia Navy Yard, before a delegation representing the Manufacturers' Aircraft Association. The plane was flown by Lieutenant A. C. McFall, test pilot. After showing slight difficulty in rising it made an excellent performance in the air. The plane which is of the monoplane type, was built in Rotterdam. It has a span of nearly fifty-six feet and a wing area of five hundred and six feet. It weighs 4,750 pounds and will carry a load of 1,320. Its rated horsepower is one hundred and eighty-five, with a duration flight of three hours.

Under most hazardous flying conditions and heavy rain, "Father William Penn," in the person of Bert De Vere, flew to Washington on November 14th, to deliver to President Harding the news of the opening in Philadelphia of the campaign of the Welfare Federation for $4,000,000. Leaving Philadelphia from the field of the Aero Service Corporation at 73rd and Island Road, at 11:05 A. M., the plane landed at Bolling Field, Washington, at 2:45 in the afternoon.

"Penn' was sworn in as a special aeroplane mail messenger and the letters to President Harding had been stamped and cancelled in regulation manner. Prominent officials witnessed the "hop off." A return trip was made the day following and a message from President Harding endorsing the efforts of the Welfare Federation was brought back to Judge J. Willis Martin. The message was handed to "Penn" by the President in person. The plane left Bolling Field at 11:13 and arrived at the home field at 2:15 P. M.

W. H. Sheahan,
1st Vice-President.

THE CURTISS MODEL CD-12 400 H. P. AERONAUTICAL ENGINE

THE Curtiss Model CD-12 400 H. P. Engine has been developed from the geared engine of the same type during the last four years. The first engine of the above construction was built in the fall of 1917 and therefore the engine is now considered to have passed the experimental stage. It has been subjected to duration tests of various kinds during its development and has been developed into a serviceable and reliable engine without sacrificing its high performance and compactness.

The engine was designed primarily for a pursuit engine to give super-performance in high-speed aeroplanes. Every part was carefully designed to give maximum strength with the least weight. The engine was made as compact as possible without sacrificing accessibility, and the engine today is one of the most accessible aeroplane engines built. Exposure of working parts has been particularly avoided both to prevent wear and to stop oil leakage, which is objectionable.

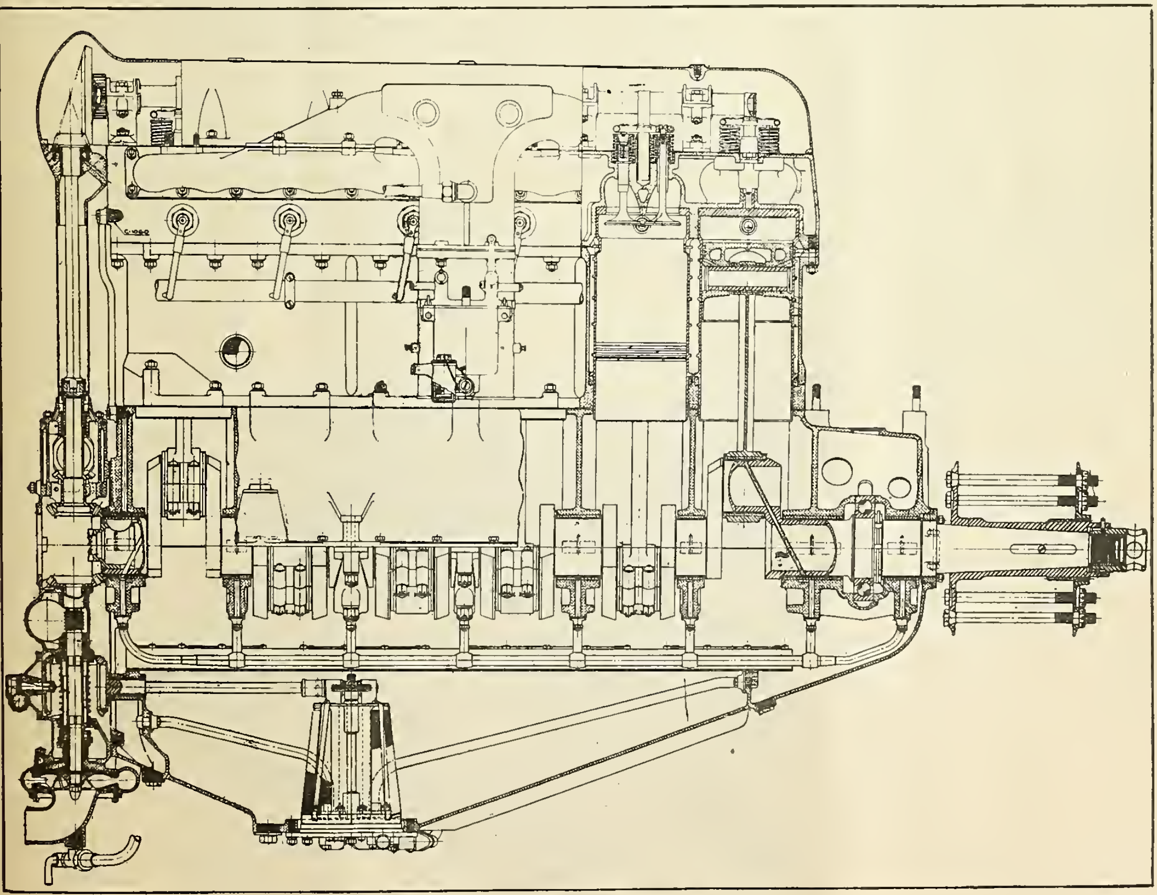
The engine runs remarkably clean and without vibration. A noticeable feature is the low temperature of the exhaust valves which run at a very dull red heat hardly visible to the eye, which is indicative of long life. The low gasoline and oil consumptions are unusual, coupled with long valve life and high engine speed. The low compression engine develops a B.M.E.P. of 137 lbs. per sq. in. gage using high test gasoline. Using doped fuel and high compression the engine develops as high as 143 lbs. per sq. in. gage B.M.E.P.

It is to be noted that with the entire cooling system, including water, the engine weighs only 2.27 lbs. per B.H.P. This figure was taken from the Curtiss Navy Racer installation, the aeroplane being the one which established a world's record of 176.7 M.P.H. on a closed circuit in the 1921 Pulitzer Trophy Race.

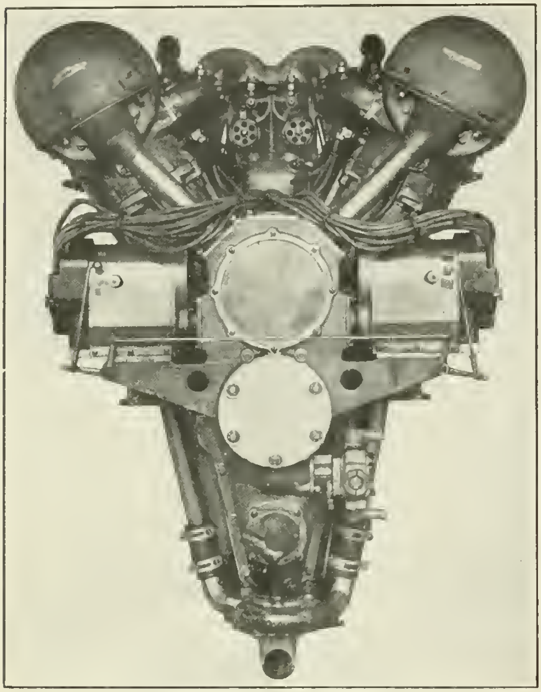
The Curtiss Model CD-12 Aircraft Engine of the 60° Vee Type consists of two rows of six cylinders having a bore of 4½" and stroke of 6". The engine has a total displacement of 1145 cu. in. The construction in general is of the aluminum cylinder type with inserted steel sleeves, each cylinder being equipped with two exhaust and two intake valves driven by overhead camshafts through bevel gears.

Cylinder Head Construction

The cylinder head proper consists of an aluminum casting formed in one piece to take six separate sleeves. These sleeves are made of high carbon steel of hydraulic forgings which are rough machined, heat treated and then finish machined before assembling in the cylinder head, with the exception of the final grinding of the bore. The sleeves are threaded at the closed end for a distance of 1½". At the lower end a gasket flange is formed and on the outside of the barrel several stiffening flanges are located approximately 1" apart. An integral stud is formed on the closed end of the sleeve which passes through the water jacket of the cylinder head after the sleeve has been screwed into the head. A nut on this stud draws the closed end of the sleeve into perfect contact with the aluminum cylinder head. After the sleeves are in place the valve holes are bored and seated, being properly spaced and aligned with the proper fixtures. Brass bushings are inserted through the side of the head for spark plugs. These bushings are tapered on the outside, to insure a tight joint. The water jacket consists of a one-piece aluminum casting which slips over the lower end of the six sleeves. In order to make a water tight joint at the lower end of this jacket a composition gasket material which resists the action of hot water, gasoline and oil, is used. The upper joint which is made between the jacket and the cylinder head with studs and nuts is made tight with a copper asbestos gasket. The lower end



Section of the Curtiss 6-Cylinder similar to the CD-12



End view Curtiss CD-12 Motor

of the water jacket is constructed with proper bosses for holding the complete cylinder head assembly to the crankcase, thereby forming a unit which is compact and accessible in case of overhauling or inspection.

Valve Mechanism

Each cylinder is equipped with four Tungsten steel tulip valves, two intake and two exhaust which are interchangeable. The clear opening is 1⅝″ in diameter while the seat is 3/32″ wide. These valves seat directly in the steel cylinder head. The valve guides are made of cast iron pressed into the aluminum cylinder head and need not be removed unless a replacement is desired. The camshafts are mounted on the top of the head on six aluminum brackets, the shafts running directly in the aluminum. There are separate intake and exhaust shafts, the intake shaft being *driven* from the exhaust shaft by means of spur gears. One cam operates two valves on each cylinder through a "tee" shaped tappet which works in a bushed hole in the cylinder head and which removes all side thrust from the valve stems, thereby insuring almost unlimited life to the valve guides themselves as well as allowing the valves to seat perfectly. The valves are adjusted by a screw in the ends of these "tee" tappets. Camshaft bearings are lubricated by pressure and the "tee" tappet bearings and valve guides by splash.

Crank-Shaft

The crank-shaft is of the conventional seven-bearing type, being made of 35-45 carbon chrome nickel steel. The drop forgings are heat treated and then finish machined. The crank-shaft has an outboard bearing beyond the propeller thrust bearing, thereby giving a very long support at the propeller end of the engine.

The crank pins are 2½ in. in diameter and 2⅛ in. long. The main bearings are all 3 in. in diameter and vary in length from 1 in. to 3 in. A bevel gear is bolted to the anti-propeller end of the crank-shaft to drive all accessories and camshafts. The propeller end of the crank-shaft carries a one to ten taper, fitted with a key for driving the propeller hub. The thrust bearing, which is mounted between No. 7 and No. 8 main bearings, consists of a deep-grooved radial annular bearing. This bearing takes the thrust in either direction.

Crank-Case

The upper half crank-case is cast from an aluminum alloy. The crank-shaft is supported on eight bearings, which are in single diaphragms, strongly ribbed to the case. Bearing caps are used to form the other half of the bearings, and are of I beam section. Each cap is fastened to the case with four studs fitted with castellated nuts. A large key way is cut in the cap and crank-case, to prevent the cap from shifting its position on the case when the engine is running.

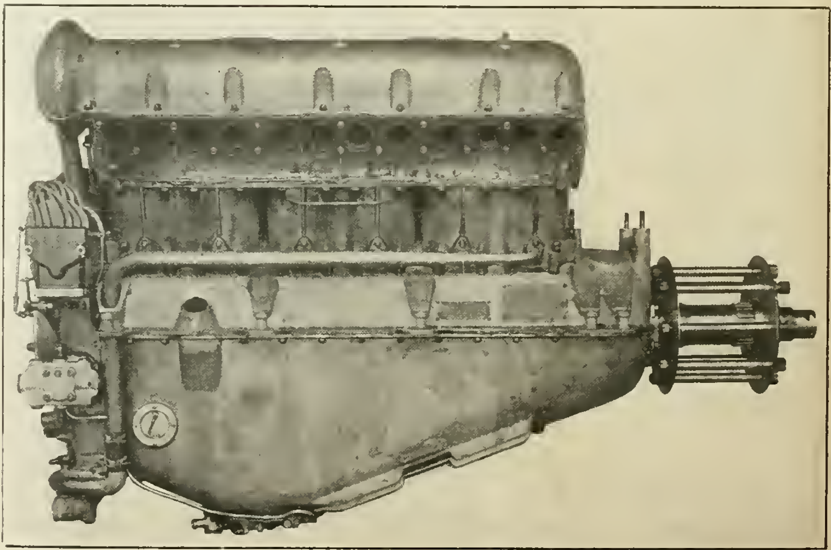
The bearings of the crank-case are fitted with bronze-backed, babbitt-lined bearing shells, which are held in place with countersunk head brass screws. These screws hold the bearings in place, and also provide a better contact between the shell and the aluminum crank-case. The bearings are bored carefully at assembly, maintaining the same clearance in all bearings.

Accessory Drive-Shaft

On the anti-propeller end of the engine is mounted a casting which carries all the shafts necessary for driving the oil pump, water pump, tachometer, electric starter, magnetos, generator, synchronizers and cam-shaft drive-shafts.

This assembly consists of one unit and can be removed as a unit.

All shafts and gears are put together with stub-toothed splines. The cam-shafts are driven through two drive-shafts through miter gears. This is made possible by the use of a short vertical shaft from the crank-shaft up to the point where lines from the exhaust cam-shafts form the proper angle for miter gears. The generator drive is taken off to the top of this vertical shaft. The synchronizer drives are taken from the two cam-shaft drive-shafts by forming bevel gears on these shafts at approximately their center. The tachometer drive is taken from a lower vertical shaft through bevel gears. This lower vertical shaft drives the water pump through a squared floating coupling. This vertical shaft also drives the oil pump through bevel gearing and helical gearing, which is mounted on the top of the oil pump. A pad is formed on the gear



Side view Curtiss CD-12, 400 H.P. Motor

case to take the Bijur starter which was developed for the Liberty engine. Magnetos are driven through flexible couplings and bevel gears from the upper vertical shaft. All the shafts in this gear case run at 1½ crank-shaft speed.

Pistons

The pistons are made of an aluminum alloy. They are of the trunk type, carefully ribbed under the head to obtain strength, and to dissipate heat. The ribs are arranged to allow even expansion from heat and to stiffen the pistons at the proper points.

There are three rings per piston, the two upper rings being ⅛ in. wide, and the lower ring 3/32 in. All rings are above the piston pin. An oil collecting groove is located directly below the lower ring with oil holes drilled through the piston walls, two of these leading to the piston pin.

The piston pin floats in the piston and connecting rod, and is held in place from lengthwise motion by means of snap rings made of piano wire.

Connecting Rods

The connecting rods are of I beam section and of the articulated type. The master rod is always assembled in the left-hand side of the engine when the crank-shaft is turning clockwise, so that the maximum pressure on the small rod will come in a line through its piston pin hole, wrist pin hole and the crank pin center. These rods are steel drop forgings, heat treated and finished all over. The upper bushing is "non gran" bronze. The lower bushing is bronze-backed babbitt, which is riveted in the rod and cap with brass rivets. The lower end of the small rod is forked and carries two "non gran" bronze bushings.

Lower Half Crank-Case

The lower half crank-case is flanged and bolted to the upper half crank-case at the center line of the crank-shaft. This case carries the oil pump drive-shaft and the oil reservoir which is separated from the crank chamber by a sheet aluminum partition.

The suction pumps are piped to each end of the case into small sumps, so that the crank-case cannot be flooded when the engine is out of normal position. An oil gauge of the cork float type with a dial on the outside of the crank-case is fitted.

Carburetion

The engine is fitted with two 52 mm. duplex Ball & Ball carburetors. Each Venturi tube feeds three cllinders through a fan-shaped manifold, which is open to the three cylinders and carburetor without partitions. The two carburetor air intakes are inter-connected with sheet aluminum conduits, which can be led to the outside of the fuselage in an areoplane.

Ignition

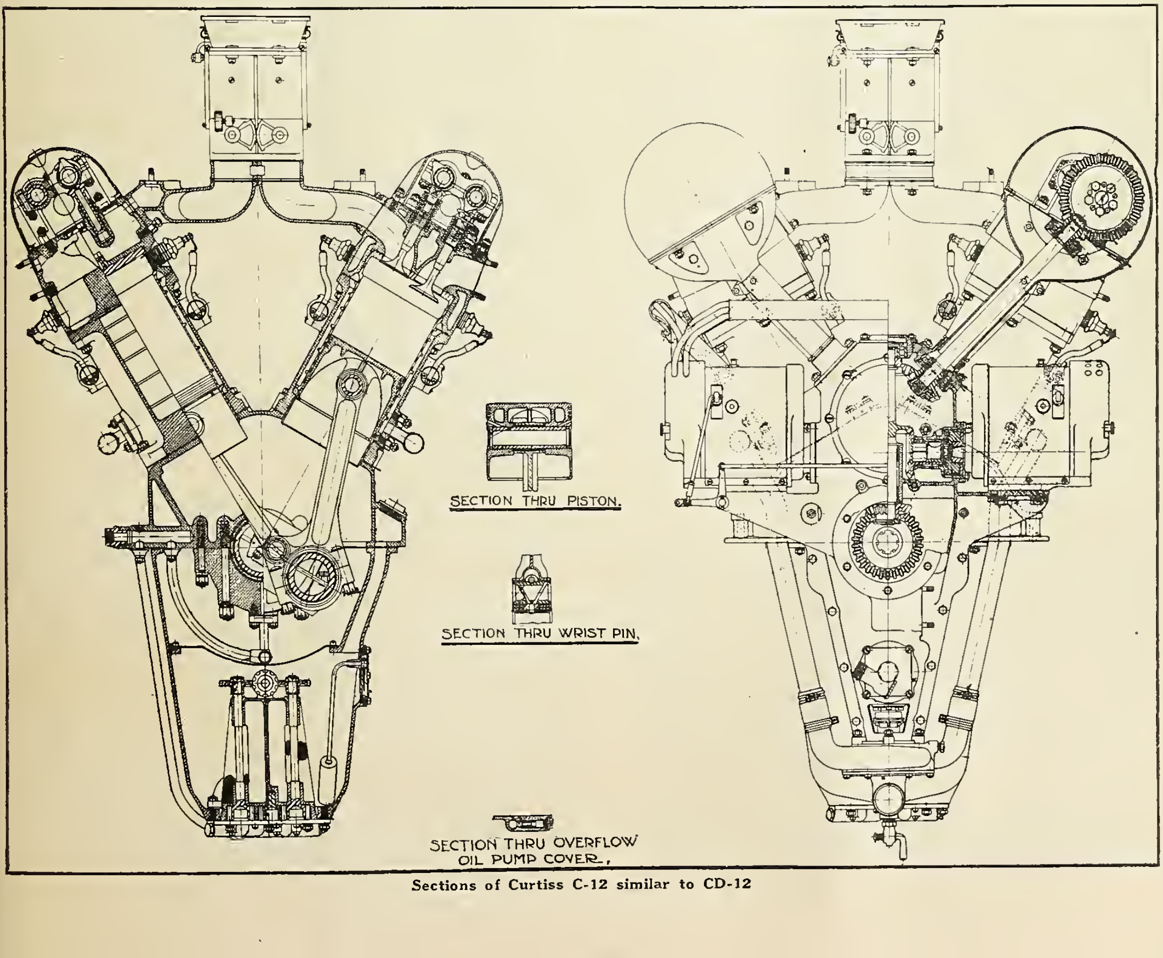
Ignition is furnished by two high-tension single-spark twelve-cylinder magnetos, driven through flexible couplings from the vertical shaft. There are two spark plugs per cylinder, which are connected to the magnetos by wires enclosed in aluminum cable tubes. The spark plugs are located at right angles to the center line of the block and diametrically opposite.

One magneto is wired to the exhaust plugs and the other to the intake plugs. These magnetos are equipped with a special switch which gives battery excitation for starting when the magnetos are fully retarded. The magnetos are the polar inductor type.

Cooling System

The cooling water is circulated by means of a centrifugal pump located at the lower end of the lower vertical shaft. This pump is of the double shrouded type, having an aluminum impeller with the intake on the lower side. The water is drawn from the radiators entering the pump through the cover, and after being discharged from the pump is directed to the lower end of the water jacket in each cylinder through tapered manifolds. The water surrounds the cylinder sleeves, passes through drilled holes of the heads, entering the cylinder heads, circulates around the ports and passes out at a point between the valves on each cylinder into a tapered manifold. From this manifold the water passes back to the cooling radiator.

The water pump is equipped with a deep-grooved radial bearing, which takes the thrust of the rotor caused by the suction of the water pump. The pump is equipped with a suitable stuffing gland to prevent leakage.



Sections of Curtiss C-12 similar to CD-12

Lubricating System

Lubrication is obtained by pressure feed from an oil pump located in the lower half crank-case, and driven as described in the section on accessory drives.

The gear pump forces the oil into a manifold which directs the oil into the bottom of each main bearing. The main journals in the crank-shaft are plugged and receive oil through three equally spaced holes in the journal. This oil then travels through a tube inserted from the journal to the crank pin in the connecting rod bearing. Tubes are also fitted in the articulated wrist pin to carry oil from the connecting rod bearings to the bearings in the small connecting rod which is forked at its lower end and carries two "non gran" bushings.

The cylinder walls and wrist pins are lubricated by splash The upper vertical shaft is fed by pressure from a duct leading from the first main bearing. Oil is piped from the anti-propeller end of the crank-case from the last-mentioned duct to the cam-shafts through the foot of the first cam-shaft bearing. Each cam-shaft is drilled at each bearing, so that oil may find its way into the inside of the hollow cam-shafts, allowing oil to lubricate each cam-shaft bearing under pressure. The cam-shaft bearings do not receive the full oil pressure, as the holes in the first crank-shaft main journal are so arranged that the cam-shafts receive index feeding twice per revolution of the crank-shaft. Oil from the cam-shaft bearings drains back into the front sump through the cam-shaft drive-shaft housings to the front gear case. This oil lubricates the ball bearings which carry the cam-shaft drive-shafts. It also lubricates the lower vertical shaft, which is carried in two bronze bushings surrounded by a pocket of oil. The oil from the connecting rod bearings and main bearings is drained into the front and rear sumps, to be drawn into the suction pumps through tubes connecting the pump with either end of the engine.

The suction pumps then force the oil into the oil reservoir below the oil pan partition. The pressure pump draws the oil through a truncated cone screen, thereby insuring clean oil to be forced into the main bearings.

A pressure regulating adjustment is provided on the cover of the oil pump. The cover of the oil pump is also arranged for connecting an oil cooler in series with the outlet of the suction pump.

Electric Starter

The engine is provided with a pad for mounting the anti-propeller and Bijur starter. This starter uses a twelve-volt battery. It is provided with a mechanism which releases whenever the engine "kicks back" when started.

Gasoline System

The gasoline system which is used in the high-speed ships equipped with the CD-12 engine is laid out as follows:

A double opposed gasoline pump, which is driven through worm gearing at approximately 1/10 of the vertical drive-shaft speed, and operates the pistons by means of a cam working in a slot in the connecting rod between the two pistons.

This arrangement provides a crank-case in the pump which has a constant volume, when the two pistons are reciprocating. Oil under pressure is supplied to this crank-case and a suitable relief valve is provided to maintain a predetermined pressure. This oil pressure seals the pistons against gasoline leakage and lubricates the piston walls. The pump forces gasoline to the carburetors, a small header tank being put in the line to dampen out pulsations. A relief valve is placed in the line to maintain a constant pressure to the carburetors. This relief valve overflows to the main tank.

A list of clearances and general specifications of the engine are given below:

Engine	*Curtiss CD-12 Low Comp.*	*Curtiss CD-12 High Comp.*
Rated H. P.	375	400
Normal R.P.M.	2000	2000
Brake H. P.	385	405
Weights		
Dry	700	700
With oil tank	700	700
With oil tank and water in system	790	790
With oil tank, water and radiator	922	922
Weights per B.H.P.		
Dry	1.82	1.75
With oil tank	1.82	1.73
With oil tank and water in system	2.06	1.95
With oil tank, water and radiator	2.40	2.27
Gasoline Consumption		
Lbs. per Hour	192.5	202.5
U. S. Gallons per Hour	32.1	33.7
Lbs. per B.H.P. per Hour	.50	.50
Oil Consumption		
Lbs. per Hour	3.00	3.24
U. S. Gallons per Hour	.39	.41
Lbs. per B.H.P. per Hour	.008	.008
With Temperatures Outlet	160	160
Overall Dimension		
Width	28¼	28¼
Length	56½	56½
Height	35	35

General Specifications

Bore—4½ inches.
Stroke—6 inches.
Compression Ratio—5.7 low; 6.1 high.
Oil Used—50% Baker's Castor, 50% Mobiloil A.
Capacity Oil Sump—5 U. S. Gallons.
Oil Pressure at 2000 R.P.M. should be 100 to 120 lbs. with the engine thoroughly warmed up.
Water Outlet—160° F.
Oil Temperature—140° F.
Spark Plugs—A. C. Aviation.

Summary of Clearances

Crankshaft to Main Bearings	.002 to .003
Connecting Rods to Crankpins	.002 to .003
Piston Ring Gap	.007 to .010
Piston Pin to Piston	.0000 to .0015
Piston Clearance	.010 to skirt
Piston Pin to Connecting Rod	.0000 to .0015
Piston Rings to Piston	.001 to .002 (Keep near low limit.)
All gears	.002 to .004 backlash
Tappets (intake and exhaust)	.015
Magneto breaker points	.012
End play in front camshaft bearing	.004
End play in upper vertical shaft	.009
End play in lower vertical shaft	.009

(*Continued from page 267*)

will permit the use of a lower powered engine and consequently smaller, lighter aeroplane than would be possible with a high wing loading. The crux of the whole matter is that wing area is determined not by maximum landing speed but by performance and maneuverability requirements.

With very large bombers, especially those of the internally braced monoplane type, the ratio of wing area to flat-plate area is so much larger than is the case with small aeroplanes that wing area can be cut without sacrificing so much. With the monoplane type the structural advantage gained by a reduction in area together with the smaller wing spread makes a consideration of devices for increasing the lift on the wings worth while.

The application of the Handley-Page idea to commercial aviation shows somewhat more promise. The aeroplanes of commerce seldom fly over 7,000 ft. so that high ceiling in itself is of little value for them. High speed, however, is of great importance. Here again the limiting condition is the minimum rate of climb required for getting out of small landing fields. As remarked in the discussion of the effect of wing loading on military aeroplanes, the use of a low wing loading permits a lower powered engine than would be possible with a high wing loading. With a specified paying load and a minimum rate of climb, it is possible to select a smaller engine with lower fuel consumption, or with a given engine, to carry more paying load, when the wing loading is kept low. Nor is the high speed sacrificed appreciably.

It is clearly evident that Mr. Handley-Page has by no means proved the value of his slotted wing even if it is possible to work out the mechanical difficulties involved in its manipulation. The only real advantage gained is that of decreased landing speed with wing loadings kept close to their present values. Even this advantage is questionable since the landing speeds obtained with present design are reasonably satisfactory.

The above discussion does not apply in any way to the development of high lift wings of the usual type which gain their high lift through the nature of their profile.—B. C. B.

THE MANEUVERS OF GETTING OFF AND LANDING *

By SQUADRON LEADER R. M. HILL, M.C., A.F.C.

PART II.—"GETTING OFF"

I. Factors Which Particularly Influence "Getting Off"

(*Continued from page 230*)

(*f*) The paragraph dealing with slipstream effects was inevitably concerned with the control of the aeroplane. During the first phase of getting off, the pilot has to rely mainly on the action of the slipstream on the elevators, fin and rudder; or has to be extremely careful if he uses them unassisted by the slipstream. During the second phase he uses his control surfaces to maintain the aeroplane in the most suitable attitude to gather speed, in order to give them effectiveness; his skill in handling is here tested, as he may in addition have to encounter disturbing forces exterior to the forces normally encountered. During the third phase he handles the aeroplane so as to maintain it at or near its best climbing speed. This speed is frequently just so much greater than the lowest speed at which the aeroplane can fly as to give him a reasonable margin of control. If the air is very disturbed he may by selecting a slightly higher speed increase this margin, which should not, however, seriously affect his rate of climb; and as a disturbed state of the air is usually associated with a wind of some sort, his height over the edge of the aeroplane will not thereby be decreased. It is a definitely dangerous practice systematicallly to underestimate the margin of control referred to, as the pilot can never quite foresee the disturbing forces he may have to deal with.

Unless it is imperative that acceleration should be as rapid as possible, the pilot does not open his throttle or throttles with a rush, but usually occupies two or three seconds over it. This serves two purposes; firstly it lessens the risk of choking the engine and secondly it gives the wheels a chance of moving before the engine is exerting its maximum force tending to pull over the nose. Especially is this necessary where the elevator is only affected by the slipstream to a small extent. Once the aeroplane is fairly moving and the air forces have begun to act on the tail, the pilot, by lifting up the tail skid so as to make acceleration as rapid as possible, enters on the second phase. Due to the low speed, he sometimes has to push the control stick forward at this time. The aeroplane will then probably bounce owing to the inequalities of the ground. The most awkward time for a bounce to occur is at the commencement of the second phase, when the elevator is down fully to lift the tail, and there is no control left to put down the nose if the aeroplane is bounced up. But speed is gathered quickly, and further bouncing is less serious; in fact, the entry on the third phase is far more frequently the result of a bounce than of the pilot's volition. After this point, the pilot should not be worried by his elevator control if the engine runs well.

On the whole, the difficulties of laterial control, *i. e.*, rudder and ailerons, are more serious at low speeds than those of longitudinal control, for lateral control is achieved by a delicate co-ordination of two organs, not by a direct use of one. A bounce at the beginning of the second phase is not infrequently accompanied by the dropping of a wing, the results of which, if the aeroplane is not headed to wing, may be serious. The yawing moment due to the ailerons has also to be reckoned with, for which the pilot has to be on the watch until he is well into the third phase.

In single-seaters and smaller two-seaters that have been fitted with balanced rudders and relatively small fins, a feature has been evident that must be clearly distinguished from the turning tendency due to the slipstream. There have been cases where although at all speeds in flight down to stalling speed the rudder has felt normal and not overbalanced, the aeroplane has swung violently and indiscriminately from side to side when getting off, and to maintain a straight course energetic paddling with the rudder has been necessary. This feature has been termed "woffling." No bite is felt on the rudder, and the behavior can be compared to the feel of an abnormally small rudder actually in flight. "Woffling" has, however, occurred in aeroplanes with quite large, and apparently under other conditions not overbalanced rudder. The rudder does not take charge of the pilot; the aeroplane simply swings; and in order to correct the swing, the pilot has, as it were, to anticipate the motion and use his rudder to the full lock. Watched from behind, the swinging of the aeroplane seems just out of phase with the rudder movements. An increase of fin area seems enough to damp out this tendency to "woffle."

(*g*) The general type of undercarriage to which pilots are accustomed is the plain "V" type, the shock absorbing properties of which are derived from elastic. There have been certain undercarriages of the "Oleo" type, and a few in which wheels have been employed in tandem.

One of the principal features with which the pilot appears to be concerned is the height of the undercarriage, which is mainly responsible for the angle of the aeroplane to the ground. No matter how safe is the aeroplane to handle in flight, it must be safe to handle in the first and second phases of getting off. Experience shows that the higher the undercarriage —with the consequent raising of the C.G. and thrust line— the more difficult is the aeroplane to handle. If the aeroplane tips over on its nose the impact is worse, and it is more likely to fling itself right over on to its back. Auxiliary forward wheels, if capable of sustaining the whole weight of the aeroplane, may of course do much to mitigate this; but the fact remains that the difficulties of getting off previously enumerated are aggravated by a high undercarriage. The aeroplane as a structure is simply top heavy; and with a high undercarriage this is unpleasantly impressed on the pilot.

When getting off on an aeroplane with a high undercarriage the tail may be lifted a certain amount and the aeroplane may feel quite normal; if, however, before the second phase is well advanced the tail is lifted more than this, it tends to come up very easily and the power of the elevator to maintain the aeroplane at a reasonable attitude feels unpleasantly limited. If the elevators are being pulled back during the second phase to correct perhaps a slight error of judgment in allowing the tail to come up too far, the pilot feels that he has not enough control left to raise the wheels clear of the ground when the suitable time arrives. The effects of bouncing under these conditions are also aggravated.

During the second phase the pilot is partly under the influence of air forces, and partly under that of the ground. He feels the bite of the wheels on the ground, and from this he estimates to a large extent the time to begin the third phase. The ordinary elastic spring undercarriages, while acting as fairly efficient shock absorbers, give a reflection of what is happening as the wheels run over the ground, which the pilot feels. The "Oleo" types, with more efficient shock absorbing properties, scarcely give the pilot any ground feel. In getting off, this is in some ways a disadvantage, though in the larger more sluggish aeroplanes that do not drop a wing suddenly, the effect on the pilot is admittedly less serious. The question of how much various pilots rely on the ground feel when getting off is however a difficult one to answer.

(*h*) It has been advanced that a low undercarriage makes it easier for the pilot in getting off. Unfortunately the chief means of arranging the wings at a large angle to the ground is the high undercarriage. Most aeroplanes, with the exception of those with abnormally low undercarriages, have their wings somewhere near the critical angle when sitting on the ground; in one or two the angle may be slightly greater, in the neighborhood of 17°. It does not appear that a large angle on the ground assists the pilot to get off, as he frequently raises his tail during the second phase so that the center line of the aeroplane is nearly parallel with the ground. It is when landing that the large angle to the ground is of assistance.

When, due to a low undercarriage, the lower planes are close to the ground, a tendency for a nose-diving couple to appear while getting off has been noticed. This nose-diving couple may be due to a cushioning effect. If the aeroplane is trimmed so as to be in balance near its normal climbing speed, during the first and second phases of getting off it feels nose heavy, and tends to keep its wheels on the ground too long. In other words the pilot has to pull it off the ground to rise into the air. On the other hand if the aeroplane is trimmed so as to be comfortable getting off, then it will feel tail heavy in flight.

Apart from this, the low position of the wings seems to make getting off more pleasant, and, if only to a small extent, to damp bouncing.

(*i*) The position of the pilot in the aeroplane and the contour of the fairing round and in front of his cockpit influence his handling in a marked way. A subconscious view of the wings stimulates his sense of lateral balance; while his sense of longitudinal balance is normally derived from some feature of the aeroplane such as a top longeron of the fuselage. He may be seated in such a position as to be denied one or both of these; and although in practice he soon accustoms himself to do without them, when available he always makes use of them. If, after flying an aeroplane with a more or less horizontal fairing in front of him, a pilot gets into one with the fairing sloping steeply down to the engine cowling or the nose, he certainly feels lost at first, and cannot gauge accurately the attitude in which he is getting off.

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* Lecture delivered before the British Aeronautical Society.

There are few pilots who, for pure controlling power, would not prefer to be situated close to the C.G. The pilot then feels that physically as well as mentally he is the hub of the machine which he controls. Curiously enough, it is more doubtful whether for getting off this is the case. During the first and second phases the feel of the controls is of less use than at other times, and the instruments are of practically no use; if the pilot is at a little distance from the C.G. the consequent accelerations on his body are an additional guide as to his attitude, which he can well dispense with, and of which during ordinary flight he finds it more pleasant to be free.

2. General Notes on "Getting Off."

During the maneuver of getting off, the influences discussed above are as a rule only felt subconsciously; the pilot is busy watching the ground, to which ultimately he refers all his actions. Though it is true that in night flying the pilot's sense of the ground is somewhat diffused, it is rare for him to take up an aeroplane at night on which he is not experienced by day.

When getting off, the pilot is really concerned with three things: his attitude, the horizontal component of his velocity relative to the ground, which he feels roughly as his air-speed, and the vertical component, which he feels as the rate he is leaving the ground. His sensory impressions are the chief clue to these three things; he refers his attitude to the plane of the ground and its perspective towards the horizon, the horizontal component to the ground moving past, the vertical component to the ground as it appears to drop away. During the third phase the feel of the controls, the feel of his seat, and the air-speed indicator are of some assistance. As the pilot accelerates in getting off, there is some mental lag in the progressive accommodation to new conditions, and he is liable to overestimate his speed, that is, he is at any moment travelling more slowly than he thinks; it will be seen that in landing the reverse is the case; he is therefore more liable to stall when getting off.

In Part I., para. (2), I divided the process of getting off into three phases. The most favorable attitude for the aeroplane during the first and second phases should be that of least resistance; the air drag is increasing, and as the wings lift more, the friction of the wheels on the ground is decreasing. Whether pilots do achieve the most favorable attitude by feel is an open question; at least they tend to keep the tail down on sticky ground when the ground friction is high. Pilots vary in their attitude during the first and second phases between keeping the tail skid nearly touching the ground and lifting it to such a height as will bring the fuselage parallel with the ground. Considering the angle that the wings are usually set to the fuselage, the latter attitude is never exceeded. On hard and uneven ground many pilots prefer to get off with the tail well down, as the aeroplane feels pleasanter when it is bumped about. This may be accounted for as follows. If the aeroplanes bounces on rough ground with the tail well up, the tendency when the wheels strike the ground is for the aeroplane to nose over, and the angle of incidence to be decreased, thus decreasing the total lift just at a time when the pilot wants it increased. If, on the other hand, the tail is down, a similar bump will increase the incidence and consequently the lift, which certainly makes the aeroplane oscillate less violently. Of course, there is always a risk of this being overdone and lateral trouble developing, but the unpleasantness does not seem so great as that in bouncing with the tail too much up. Again, if the pilot gets bumped up to a large angle of incidence, he may not have enough control to put the nose down gently; instead of this, the nose-diving couple comes into play and the nose drops too violently, the wheels again strike the ground, and an increasing kind of oscillation is set up. The pilot must exercise his discretion both ways, and good style is the result of a happy compromise.

The co-ordination of the rudder and ailerons has been referred to as worth the pilot's close study. The sort of difficulty which frequently arises is as follows. The pilot is in the second phase, and due either to an air disturbance or a bump in the ground, one wing is thrown up and the other is dropped. The pilot tries to pull up the wing by using his aileron, in which he may perhaps be successful. At the same time the aeroplane tends to yaw due to the effect of the ailerons at low speeds. This yaw he has to correct with his rudder; but if his rudder control is all but used up in counteracting the rapidly developing turning tendency (referred to in Part II., para. (1) (*d*) and the aeroplane is caused to yaw the same way as it is tending to be turned by the slipstream, the rudder may be inadequate to deal with the two effects added together.

It sometimes happens in flying that the pilot comes to the limit of his controlling powers before he has achieved what he wants; the only thing he can then do is to allow the aeroplane its own will and gently convert its motion into another maneuver, which is the next best to that he desires to achieve; it is absolutely no use trying to use the controls in the vain hope of achieving the impossible, for in doing so serious elements of danger at once appear. Two examples of this can be given.

Take the case referred to in getting off. One wing has dropped. The pilot dare not attempt to raise it due to the rudder being inadequate to cope with the yawing moment produced by the ailerons added to the turning tendency. He simply has to allow the wing to remain down, very near the ground, and get off on one wheel, converting the motion, if he can accelerate the aeroplane sufficiently to lift the wheel off the ground, into a gentle climbing turn. The dropped wing will then give the correct bank for the turn. He will now in a natural and flowing manner have converted a straight get-off into a get-off with a gentle climbing turn, although he had, as it were, to change his mind in the middle of the second phase.

Again, suppose the pilot has got off with a steep climbing turn in order to avoid some obstacle. He has to watch his flying qualities carefully because due to the turn he will be much nearer stalling point. Then, owing to a slight error of judgment, he finds the aeroplane partially stalled at about 200 feet from the ground. The controls begin to fail him. What is his only method of recovery? He must lose some of his precious height to regain a margin of speed and control, and he must lose it in the most economical way. He must let the aeroplane fall into a turn in continuation of the climbing turn, swinging round again towards his starting point, gently easing the nose down with as little control movement as possible. Were he to move any of the controls violently in this critical state he would stall, and the nose-diving couple would crash him nose on into the ground. The most frequent mistake is to try and straighten off the turn by moving the rudder violently against it and pushing the stick forward in an attempt to put the nose down. The pilot thinks that if he could get straight he would regain control. No idea is more fallacious and as soon as he attempts to move the rudder across he stalls with a violent sideslip, and gets completely out of control. Aeroplanes which exhibit weather-cock instability more especially have to be handled with care in climbing turns off the ground. If the pilot is trying to avoid obstacles, or maneuvering for a good position as early as possible should his engine fail, a climbing turn falls into the category of forced maneuvers.

The effect of wind has not hitherto been considered. If the pilot is not restricted in any other way, of course he gets off up wind. If, however, he has to surmount a serious obstacle in getting off up wind, and there is a clear run down wind, he may select to risk a less pleasant get-off down wind for the sake of the clear run. It requires much more skill to get off across wind than up or down wind, due both to the difficulties of the aileron and rudder control and the incapacity of the undercarriage to stand up to lateral loads. Again, if there is a breeze blowing at 100 feet from the ground, the wind gradient in the neighborhood of the ground seems usually quite steep, and luckily for the pilot the air within three of four feet of the ground is seldom disturbed. Especially does this appear to be so at night. If the pilot gets off up wind, the wind gradient helps him in the form of an additional insurance against stalling, because he gathers speed more quickly. Getting off down wind, it acts just as surely against him; therefore no pilot would think of getting off down more than a comparatively gentle wind, except on a relatively high-powered aeroplane.

Getting off across wind is a different matter. Again, it is only attempted with relatively high-powered or maneuverable aeroplanes. The great thing is to curtail the first and second phases in order even at the risk of stalling to get the aeroplane clear of the ground as soon as possible, and then to drop the wing that is towards the wind, sideslipping into it, to keep a straight course over the ground. In fact, if it is practicable, the wing should be dropped during the second phase, and the get-off effected on one wheel; for if the risk of being blown right over is to be eliminated, the wind must not be allowed to get under one wing. When getting off across wind, lightly-loaded aeroplanes are the more difficult to handle during the second phase, due to the more violent effect of the wind; heavily-loaded aeroplanes during the third phase, due to the higher stalling point, and the temptation of the pilot to get them off at too low a speed.

(To be continued)

NAVAL and MILITARY AERONAUTICS

General Patrick Visits Langley Field

General Mason Patrick, recently appointed Chief of Air Service, with Major Oscar Westover, Chief of Balloon and Airship Division, Major Mars and Lieut. Whitley, Adjutant, Bolling Field, went from Washington on October 18 to inspect the new airship Roma, recently purchased from the Italian Government by the United States. The General and party were passengers on the C-2. The C-2 left Aberdeen at 6.30 a. m. Took the General and party aboard at Bolling Field and left there at 8.01 a. m. She arrived at Langley Field at 12.30 p. m. The General had lunch with Lieut.-Col. Danforth, Commanding Officer of Langley Field, and after lunch, completed the inspection of the Roma, and leaving this station at 3.00 p. m. returned to Washington.

Army Air Service Types

The U. S. Army Air Service's classification of aeroplanes for military purposes has no less than fifteen different types considered as necessary for future operations, as follows:

Type	*Description*	*Type Symbol*
I	Single-seater Pursuit — water cooled engine	PW
II	Single-seater Pursuit for Night Attack—air or water cooled	PN
III	Single-seater Pursuit — Air cooled engine	PA
IV	Single-seater Pursuit for Ground Attack—air or water cooled	PG
V	Two-seater Pursuit — air or water cooled	TP
VI	Two or Multi-seater for Ground Attack—air or water cooled	GA
VII	Two-seater Infantry Liaison—air or water cooled	IL
VIII	Two-seater Night Observation—air or water cooled	NO
IX	Two or Multi-seater Army and Coast Artillery Observation and Surveillance—air or water cooled	AO
X	Two-seater Corps Observation—air or water cooled	CO
XI	Two or Multi-seater Day Bombardment—air or water cooled	DB
XII	Two or Multi-seater Night Bombardment, Short Distance—water cooled	NBS
XIII	Multi-seater Night Bombardment, Long distance—water cooled	NBL
XIV	Two-seater Training—Air cooled engine	TA
XV	Two-seater Training—Water cooled engine	TW

Carlstrom Field 100% Membership

Major Ralph Royce, Commanding Officer at Carlstrom Field, Arcadia, Fla., has sent to the Army and Navy Air Service Association headquarters, Star Building, Washington, D. C., thirty-one applications for membership, being 100 per cent membership at that field.

Major W. Jefferson Davis

W. Jefferson Davis, formerly major, has recently been appointed a member of the Aviation Committee of the American Bar Association. Major Davis went to Cincinnati to attend the recent convention and there took occasion to oppose the constitutional amendment which by some has been suggested as necessary.

Captain Mustin, U. S. N.

Capt. H. C. Mustin, U. S. N., has been relieved of the command of the Pacific Air Squadron to be assigned to the duty in the Navy Department as Assistant Chief of the Bureau of Aeronautics. He will succeed Commander W. J. Giles, U. S. N., who is due shortly for sea service. Captain Mustin is a pioneer in the Naval Air Force. While in command of the Pacific Air Squadrons, he has been very active in the development of aeronautics on the Pacific coast. One of his feats was to lead his squadron on a flight to the Canal Zone during the mobilization of the fleet last winter.

Army Gets Navy Dirigible for Bomb-Proving Purposes

A hangar for C-type airships has been erected for the Army Ordnance Department at Aberdeen Proving Ground, Maryland, and the airship C-2 has been sent there.

The C-type of ship has a gas capacity of 108,000 cubic feet and a useful lift in excess of 2,000 pounds at bombing altitudes. Bomb racks and rights are being installed in the ship for the dropping of bombs up to 1,000 pounds in weight.

The airship will be used for carrying an extensive tests of dropping various sorts of bombs from aircraft.

New Head Appointed for Research Bureau

Orders have been issued by the Navy Department designating Captain Ernest L. Bennett, now in command of the U. S. S. New York, as the next director of the naval experimental and research laboratory, which is rapidly approaching completion at Bellevue, just below Washington on the Potomac River. Captain Bennett will relieve Rear Admiral Wm. Strother Smith, U. S. N., retired, who developed the laboratory project, and who has from its inception labored unceasingly for the success of the scientific establishment. Captain Bennett will also relieve Admiral Smith of his other duties.

Helium in Navy Airships

Plans are in progress to make practical use of helium in U. S. Navy airships. An immediate start is to be made in experiment with gas at the naval air station, Hampton Roads, Va., where a non-rigid airship of the C class will be inflated. This experimentation is being conducted in connection with tests in regard to buoyancy, valve control, permeability of airship fabric, and methods of handling helium in connection with all types of lighter-than-air craft. This will be the first airship in the world to be so inflated, and it is expected that important data will be obtained, which it is hoped will be of considerable value in future employment of the gas. This is in accordance with the provisions laid down by the Aeronautical Board of the Army and Navy for the experimentation and development of lighter-than-air craft.

Changes in Personnel at Naval Air Station

Washington, Nov. 1.—Orders issued by the navy department today as follows: Lieutenant Commander Alston R. Simpson from Pensacola naval air station to San Diego naval air station; Lieutenant Guy D. Townsend from Pensacola naval air station to Atlantic fleet air squadrons; Lieutenant John D. Alvis, from U. S. S. Great Northern to Pensacola naval air station.

General Patrick Inspects McCook Field

For the last few years it has been customary, usually semi-annually, to hold an inspection of the Engineering Division at McCook Field for the purpose of formulating policies as to the carrying out of the experimental programs thereat. The inspecting party on the trip made on October 23rd represented the operating units of the Air Service and studied the equipment from the standpoint of its adaptability for use in the field. The party consisted of men qualified along the various lines of activities found in the field.

The inspection party was headed by General Mason M. Patrick, Chief of Air Service, and General William Mitchell, Assistant Chief of Air Service. General Patrick arrived at McCook Field by train, accompanied by Major Kilner, on October 24th, spending two days in the inspection of McCook Field and the Intermediate Depot at Wilbur Wright Field, returning to Washington on the evening of October 25th, while Major Kilner remained until October 27th. General Mitchell and the remainder of the party made the trip to Dayton and return by aeroplane. The remaining personnel of the party included Captain Walter R. Lawson, Captain Louis R. Knight, Lieut. Clayton Bissell, Lieut. Richard T. Aldworth and Lieut. Carl A. Cover, from Langley Field, and Captain Burdette S. Wright and Captain William C. Ocker from Washington. General Mitchell and Captain Wright, flying DeHavilands from Washington on October 23d, were met by Captain Ocker at Moundsville, who accompanied them to Dayton. Captain Lawson flew a Martin Bomber No. 1 to Dayton from Langley Field, carrying with him Captain Knight. It is interesting to note that this plane flown by Captain Lawson was the same plane used in the sinking of the *Ostfriesland* and the *Alabama* and in connection with the mining strike troubles at Mingo County, West Virginia, Lieutenants Bissell and Aldworth made the trip in DeHavilands, while Lieutenant Cover took the Thomas Morse pursuit through from Langley Field.

A thorough inspection of the field was was made by the party. The various types of pursuit, bombardment, attack and observation planes were flown and, in the case of pursuit and observation, the planes were maneuvered against each other by the various members of the party, in order that a complete study of the characteristics in the air could be made. In making this study over 130 flights were made during the week by General Mitchel and his staff.

General Patrick, General Mitchell and the staff were most enthusiastic about the work being done at McCook Field and the various types of planes, of which experimental models were present, or the preliminary drawings and characteristics worked out. The inspection was completed November 2nd.

FOREIGN NEWS

International Aviation Rally at Loreto, Italy

A report on the International Aviation Rally held at Loreto, Italy, on September 11th last, has just been received from the Military Attaché at Rome. Major James E. Chaney, Air Service, Assistant Military Attaché, attended this meet. The following program was carried out:

7:30 a. m.—Three flights of four aeroplanes each made formation flights over certain assigned sections of the Adriatic Coast to a distance of 30 kilometers inland. The flights were of bombardment, reconnaissance and pursuit planes, and to each flight was assigned a mission involving the principles of these specialties. The flight carrying out the most successful misison was awarded a handsome cup presented by the War and Navy Departments jointly.

10 a. m.—Benediction by the Cardinal of Loreto of the aeroplanes in flight over Loreto.

10:30—Religious ceremony.

12:30 p. m.—Official reception of all the pilots and authorities at the Royal Palace.

1:00 p. m.—Banquet in the Ryoal Palace.

4.00 p. m.—Presentation of insignia and prizes.

A concert, a lottery for the benefit of an orphan asylum for children of aviators killed in the war, fireworks and various other events occupied the rest of the afternoon and evening.

The Rally was attended by high officials of the Italian Government and of the Church, and by representatives of several foreign countries. A squadron of six Swiss aeroplanes was also present.

This Rally was in recognition of the adoption by Italian aviators and Catholic aviators abroad of the Madonna of Loreto as their patron Saint. The Italian Government has given official recognition to this patronage just as the Infantry, Artillery and Cavalry arms of the service each has its patron saint.

It may be interesting to know why the Madonna of Loreto was selected as the patron saint of aviators. In the cathedral of Loreto, a small village overlooking the Adriatic. near Ancona, is the House of the Virgin which was originally at Nazareth. Some centuries ago this house was moved, supposedly by miracle, from Nazareth to the Dalmatian coast. It remained there for some time, and about 600 years ago it was transferred, supposedly by a miracle, to its present position, which was then a laurel grove, and the present town gradually grew up around the place. This house is now in the cathedral and is protected and surrounded by a marble grating with numerous old sculptured figures representing the small house in the air during the various stages of its supposed flight to Loreto.

Air Service in Mesopotamia

In accordance with plans approved a year or more ago official steps, it is stated, are being taken towards replacing the greater part of the army of occupation in Mesopotamia by units of the Royal Air Force. This will not only tend to save the government many millions a year in expenditures for the army, but will afford a great object lesson in the value of aircraft in carrying out the almost purely police duties of an army of occupation.

R. A. F. in India

The Indian Group of the Royal Air Force is being reorganized. and will in future comprise four wings instead of two, although the number of squadrons will not be increased. The new distribution of units is as follows:

R. A. F. Headquarters, Ambala.

No. 1. Indian Wing: Headquarters, Peshawar; No. 20 Squadron, Kohat; No. 31 Squadron, Peshawar.

No. 2. Indian Wing: Headquarters R. A. F. School, and No. 28 Squadron, Ambala.

No. 3. Indian Wing (new formation): Headquarters and No. 5 Squadron, Quetta.

No. 4. Indian Wing (new formation): Headquarters, No. 27 Squadron, and No. 80 Squadron, Risalpur.

Aircraft Depot, Karachi. Aircraft Park, Lahore. The Aircraft factory at Lahore is no longer required and is to be disbanded.

The Air Officer Commander of the Indian Group is Air-Commodore T. I. Webb-Bowen, C. B., C. M. G. For operational purposes, the group is under the command of the Commander-in-Chief, India.

Danish Regulation

Denmark is engaged in completing a system of conventions regulating air traffic. An agreement with Norway was recently signed, and a conference between Danish and German delegates will begin at Copenhagen for the conclusion of a convention similar to that between Great Britain and Denmark. These arrangements will prove useful when aerial intercourse, which is at present quiescent, comes to be re-started, as it will then be no longer necessary for airmen to obtain a special permit to land on every occasion, as is now the case. Conventions on the same lines with Sweden and Finland are also being prepared.

Chinese Aerial Mail

An official Chinese circular has been issued regarding the Peking-Tsinan Aerial Postal Service which was inaugurated on July 1st and not August 1st as was officially stated previously. Regulations governing the carriage of mails or parcels are briefly as follows:

1. The Pekin-Tsinan Aerial Postal Service will carry mails and valuables. No passengers will be carried for the time being.
2. The service from Peking to Tsinan will be on Wednesday, Fridays, and Sundays, while from Tsinan to Peking the service will be on Tuesdays, Thursdays and Saturdays.
3. Machines will leave Peking on the scheduled days at 5 p. m., while they will start on their return trip at 10:30 a. m. The journey will be covered in two and a half hours.
4. The Peking terminal station will be Nanyuan temporarily, and that at Tsinan will be near Tuan Tin, Tsinan.
5. Besides the regular postage, mail or parcels carried by the service will pay aerial postage, the amount of which will be announced by the Chinese Post Office.
6. Aerial stamps will be on sale at all Post Offices.
7. Ordinary mails and parcels will be received at all Post Offices, but valuables must be taken for transportation to the Preparation Bureau of the Pekin-Shanghai Aerial Service Administration, Peking, or either the Peking or Tsinan Aerodrome.

Dirigible Construction in Spain

An arrangement has been reached between the Compania Trans-Atlantic and the Zeppelin Company of Germany for the construction in Spain of two rigid airships, each 250 meters long, 38.8 meters in diameter, and with a gas capacity of 180,000 cubic meters.

An air base is to be established in Spain (between Sevilla and Cadiz) where one shed will be built. A base has also been selected in the Argentine Republic where two sheds one revolving—will be erected. The manufacture of the sheds will require an estimated time of two years. The sheds themselves can be built in much less time.

A smaller ship of the capacity of 50,000 cubic meters will be used for service between Spain and the Canary Islands, and for the training of pilots.

Japanese Aviation

It appears that Japan is sparing no efforts or expense to building up a great military and civil air force. From England representatives of Messrs. Short Brothers and from the Sopwith Aviation Company have gone to the East to superintend the building of British-designed machines. In addition, a number of R. A. F. officers have gone to Japan to organize the Japanese naval air service. Japan has enrolled some of the leading British designers and engineers. Shipbuilding firms have acquired foreign licenses for the manufacture of naval aircraft and aeronautical engines, and several European firms have established branches in Japan. In addition, military and naval deputations from the East have been for some time inspecting factories and machines in Great Britain, and orders for British, French and Italian machines have been placed with various firms.

Helicopter Flight

In an interesting article in the London Observer Major C. C. Turner comments on helicopter flight as follows:

Experiments with helicopters—machines with horizontal screws giving vertical ascension are being carried on in many countries, and in Great Britain, the United States. and France are helped by the Government. The results of late have been far more encouraging to the inventors than were those obtained before the war, and there is no doubt that the great progress in aerodynamics due to aeroplane research, especially under the stimulus of the war, is helping the helicopterist.

References to helicopter experiments are often sensational. It is made to appear that vertical flight is what the whole aeronautical world is breathlessly awaiting: that it will revolutionize flying, since it would enable machines to land on flat roofs and to hover over an enemy. Yet upon consideration one seriously doubts whether even complete success with the helicopter would make much difference; although one would not go so far as to say that experiments are without scientific value.

Criticism of the helicopter usually takes the form of pointing out that, if the engine fail, descent will be as vertical as the ascent and a hundred times as fast. The criticism is met by the assurance that the helicopter whose engine fails may descend slowly, which was proved in England and elsewhere with large-scale models some years ago. Admittedly there are mechanical difficulties in ensuring the rotation in the right direction, under the pressure of the air, of the propellers in the event of engine stoppage; but the difficulties appear to have been overcome by certain experimenters.

Another difficulty is that of securing horizontal speed and direction. This has been solved, theoretically, by a slight inclination of the axis, so that the screws rotate in an inclined plane when, it is claimed, very great speed is attainable. The preservation of balance is another problem which, however, has in theory been solved in more than one way, always, however, by mechanism admittedly complicated. Practical proof has not yet been given; and one cannot but fear that this and other elements of the helicopter proposition will demand a toll of damaged machines and, perhaps, of life.

M. Damblanc, discussing the experiments at a meeting of the Royal Aeronautical Society, had to admit that a descent with engine stopped would be at the rate of about ten miles per hour; and this, of course. in vertical contact with the ground to a machine weighing half a ton or more, would mean serious risk of wrecking; it would certainly call for a very remarkable shock-absorbing contrivance, which would be very heavy. And, if under the influence of wind, the descent were aslant the difficulties would be increased.

None of the helicopterists can yet claim that balance could be so nicely preserved in the last 100 feet of descent, where the air is so often "uneven," as to make the landing perfect. Still more disturbing is the thought that the engine might fail at so low an altitude that the fall-checking action of the propeller could not take effect.

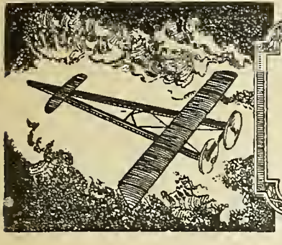
The aeroplane, on the other hand, lands on a gentle gradient, so that even high speed is, within limits, no danger; and wind makes it easier by reducing the ground speed.

On the whole proposition, including that of the conversion of power expended into useful work done, it would seem that the aeroplane must have the best of the argument. Perhaps the difference between the two may be likened to the difference between using wheels in mechanical traction and attempting imitation legs!

As regards performance, there remain some serious drawbacks to the helicopter. M. Damblanc, one of the foremost workers, has to admit that the utmost height attainable by his design would be about 5,000 feet, and that as that height was approached ascent would be extremely slow, and would call for the sacrifice of all impediments. If this, indeed, be the limit, the prospects before the helicopter, whether for war or for commerce, are gloomy. Of course, we must assume that, as in the aeroplane, the limit of to-day will be surpassed to-morrow. But any important development in power, yielding more thrust in proportion to weight, would benefit the aeroplane quite as much as it would the helicopter.

Of reported helicopter experiments may be mentioned those of Berliner and of Hewitt and Crocker in America; the combined aeroplane-helicopter of Pescara, the Spanish inventor, which ascended to 3½ feet the other day; Mr. Louis Brennan's machine in England; and the work of Mr. Ellehammer, the Danish aviator who flew an aeroplane as long ago as 1906. The first helicopterist to be injured was M. de Payer, who broke an arm last year, and who is said to have ascended to 400 feet the other day, his machine then being wrecked. Then there is the Petroczy helicopter, which in its first experiments has been held captive on a cable; and it is suggested that it might supersede the kite-balloon, being equally good for observation purposes without offering so big a target or requiring so much space or field equipment.

The aeroplane, meanwhile, is steadily being improved, especially by means of the new high-lift wings. And high-lift wings that could be varied during flight, especially in conjunction with propellers of variable pitch, would greatly increase the range of speed, enabling very fast machines to land slowly and in small spaces.



ELEMENTARY AERONAUTICS *and* MODEL NOTES

The Model Exhibition at Omaha

AMONG the model aeroplanes on exhibition during the International Aero Congress in Omaha, in the window of one of the city's largest stores, the Burgess-Nash, were the Loening Special, made by R. W. Wilmer; scale models of the Curtiss JN; the De Haviland 4; a gasoline engined model of the Continental Pusher Biplane constructed by A. H. Fetters of Omaha, and three models built by C. J. Fastje—the Curtiss 18-T Triplane, an A-frame racer and the compressed-air monoplane.

A good crowd was on hand at all times, both day and night, to view the exhibition of models.

The Fastje Triplane, shown in the illustration below, weighs only nine ounces By shortening the motor-stick a couple of inches and making the propeller a little heavier, Mr. Fastje succeeded in getting the model to balance at about one-third of the way back on the middle plane.

Model Exhibition in Gothenburg, Sweden

The model department of Aerial Age has been invited to send exhibits to an exhibition which will be held in Gothenburg, Sweden. The notice having been received too late for reply, models could not be sent in time, as the event is scheduled for the last week in November.

Exhibits are to include scale models and flying models; drawings, sketches and photographs. The work is under the auspices of "Kungl. Svenska, Aeroklubben, 1 Gotenborg," Hotel Savoy, Gothenburg.

Model Used for Omaha Poster Design

The clever poster designed by Eyre Powell, and used to advertise the International Aero Congress in Omaha, November 3rd, depicts a Loening racing aeroplane. The plane it illustrates was actually a 30-inch scale reproduction of the Loening, made by Mr. R. Wilson Wilmer of Brooklyn. This model was described in the June 13th issue of Aerial Age, together with three photographic views. Its realistic appearance attracted the attention of the Omaha Congress management who arranged for its purchase for the poster, and it proved to be well adapted for the purpose.

The Effect of Staggering a Biplane

An investigation carried out at the Massachusetts Institute of Technology wind tunnel, of the aerodynamic effects of stagger was more complete than had been made before, and therefore of considerable value. This information was sought because staggered biplanes have certain advantages from the point of view of visibility.

The conclusions of this test, which was made with aluminum wings 3 inches by 18 inches, the upper having a U. S. A. 15 section and the lower an R. A. F. 15 section, show that it is advisable from the point of view of aerodynamic efficiency to use the highest possible degree of stagger. Moreover, a positive stagger greatly restricts the centre of pressure travel, thus simplifying the problem of stability.

Flight Association Will Use Wind Tunnel

A thirty-six inch wind tunnel, of the Eiffel type, now nearing completion, will be used by the Long Island Flight Association to test the lift and resistances of bird-wing sections, etc.

The tunnel is of the open chamber type which permits the use of larger models than other types in use. As far as known, this will be the first privately owned testing tunnel in the United States. Its use will place the L. I. F. A. members at a distinct advantage in gathering information useful for application on soaring and gliding apparatus.

The balance mechanism will vary slightly from the standard Eiffel type, though as accurate results are promised. Data adaptable to dynamics as well as soaring flight will be recorded. Actual bird-wings will be procured and prepared for tunnel tests the same as the usual model wings are tried out. As practical data on bird-wings is extremely limited, it is probable that greater attention will be given to this work, especially since several of the club members expect to build gliders and soaring machines.

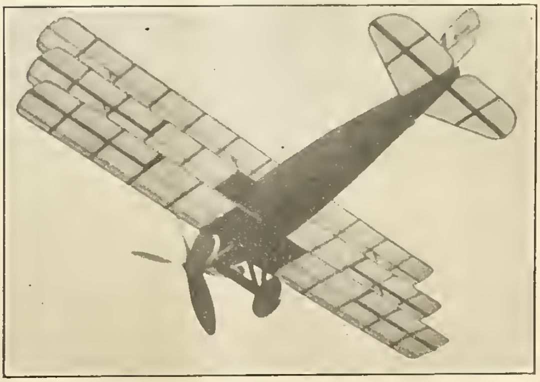
Those concerned in the building of the tunnel are familiar with the requirements of such work, having been directly connected with model building and wind-tunnel testing according to the requirements of the U. S. Government. The accuracy of the tunnel will, upon completion, be calibrated by recording the results obtained from tests on standard wing sections of which the lift and drift values are already established. The wing-section to be used is one of the U. S. A. curves, and the model of it will be accurately to scale to within one ten-thousandth of an inch.

Power to generate the air currents will be supplied by a four-cylinder water-cooled gas engine of 25 horsepower. It will drive a four-bladed propeller of 5 feet 6 inches diameter and low pitch so that the air flow can be made variable between 5 and 30 miles an hour, which is sufficient to cover the speed ranges to be dealt with in actual flight computations.

Mr. Charles B. Hayward, author of "Practical Aviation," in referring to the value of laboratory experiments, writes:

"There is yet so much to be learned regarding atmospheric laws and their influence upon flight that well-equipped experimental laboratories are indispensably necessary to the further progress of aviation. Just as the initial success of the Wright Brothers was the culmination of years of scientific research which demonstrated the worthlessness of many theories that for years previous had been regarded as well established, so the development of the future will be the result of consistently carried out lines of investigations rather than the outcome of chance discovery. The practical use of the aeroplane in the hands of such a large number of aviators will undoubtedly lead to improvement in construction and design, but for that thorough knowledge of the principles which is essential to increased efficiency and finality in design we must look to the scientist and his laboratory."

When the L. I. F. A. tunnel has been completed and tested, a report will be made dealing with its design and construction, and information upon experiments carried out by the club members will be published when the results are regarded to be of general public interest.



A Curtiss 18-T Triplane made from scale model drawings published in the Sept 5th Aerial Age

A-E-R-O-N-I-T-I-S

I have a story to tell you
  Who fly up in the air
If you have an OX5 motor on the prop
  Take it from me: Beware.
They back-fire, spit and sputter
  They never rev up high
If there's a fence in front of you,
  Just kiss yourself goodbye.

If it's a LeRhone you're depending on
  To carry you anywhere,
Just give her the gas and hope for the best
  And don't forget the air.
She'll sling oil, she'll cough and sputter,
  You'll think she is going to stop,
But feed her gas and air just right
  And she revs a wicked prop.

If you've a Hisso up in front
  You can pat yourself on the back
Because you can go wherever you start
  And be sure of getting back.
Don't warp her valves, "Handle with care,"
  Be leery of her stick,
She fires when you least expect it
  And she's got an awful kick.

But give me a smoking Liberty
  A-roaring in the wind,
Rocker arms leaping in the breeze,
  Twelve cylinders snarling grind.
Four hundred horsepower in your lap,
  A good ship 'neath your feet,
Sky above, earth far below,
  Say, boy, this life is sweet.

J. B. G.

Discouraging

Pat: Gee, this English language is sure awful. When I discover that if I am quick, I am fast; that if I was tied, I was fast, and if I spent too freely, I was fast, I was discouraged!

But when I came across this sentence: The first one won one prize, I was tempted to give up trying to learn English.—*Chicago News.*

Teacher: John, start a story for us.
John: I can't.
Teacher: Mary, you start it.
Mary: Once upon a time there was a boy named Ooglesby.
John: And Ooglesby died.

Gave Her Away

"Who gave the bride away?" asked Mrs. Jones of her daughter, who had just returned from a wedding.

"Her little brother," replied her daughter, "he stood up and yelled 'Good, Blanche, you've got him at last.'"—*Baltimore American.*

The Three Toads

A tree toad loved a she toad
  That lived up in a tree;
She was a three-toed tree toad,
  But a two-toed toad was he.

The two-toed tree toad tried to win
  The she toad's friendly nod;
For the two-toed tree toad loved the ground
  The three-toed tree toad trod.

But vainly the two-toed tree toad tried—
  He couldn't please her whim;
In her tree toad bower,
With her V-toed power,
  The she toad vetoed him.

—*Chicago Tribune.*

Customer: What is that Japanese idol worth?
Clerk (in a subdued tone): Worth about half a million; it's the proprietor.—*Junior League.*

Tommy: I like a girl who is reserved; don't you?
Jack: Yes, and especially if she is reserved for me.

May: These poor girls have to work fifteen hours a day. Isn't it a shame?
Grace: Why do you trade here, then?
May: They sell things so cheap, that's why.—*Flying Pat.*

Oldboy: What *has* become of the old-fashioned girl who used to say, "Ask father"?
Newguy: She now has a daughter who says, "Give it more gas, George, the old man is gaining on us."—*Mirror.*

Teacher: How is South America divided?
Bobby: By earthquakes.

Captain: Well, my boy, it's the old story I suppose—the fool of the family sent to sea?
New Middy: No sir, that's all altered since your time!—*Sailors' Magazine.*

Highlanders are the best ventilated people in the world. Now, John, can you deny that?

Old Lady: I see tips are forbidden according to that sign up there.
Waiter: Why, bless yer ma'am, so were apples in the Garden of Eden.—*Flying Pat.*

Sentry: Halt! Who goes there?
Colonel: Friend.
Sentry: Halt!
Colonel: You've hollered that twice and I answered. Why twice, man.
Sentry: Well, orders are that I am to yell, "Halt" three times and then fire.—*Farmer's Wife.*

Bob: Do handsome husbands pay?
Ian: Well, I guess they pay whether they're handsome or not. I'm not good looking, but I bought my wife a string of pearls and now I pay my first one alimony, too.—*Flying Pat.*

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(*With apologies to Mr. Rudyard Kipling*)

If you can study hard to get your lessons
Yet not forget that study isn't all;
If you can keep your faith, not make confession
That the chances for success seem awful small;
If you can "dig" and form your own impressions,
Dig hard, dig deep, dig broad;
If you can write and make it well worth reading,
Can master math and not say it's a fraud;
If you can study language—science,
Bar none and nevr say, "I can't;"
If you can enter into athletics
And help to win, though but by margin scant;
If you can foster greater interest,
Inspire vim, and in kndness never stint;
If you can play, but not let playtime
Cost too dear nor leave too great imprint;
If you can keep your standard high,
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A student that the U will bow before.

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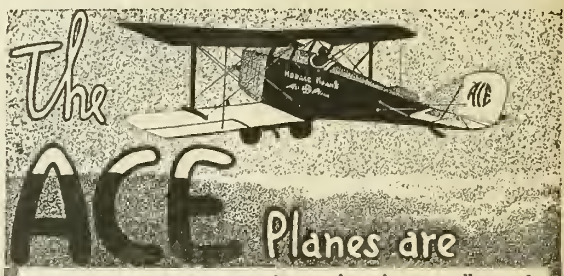

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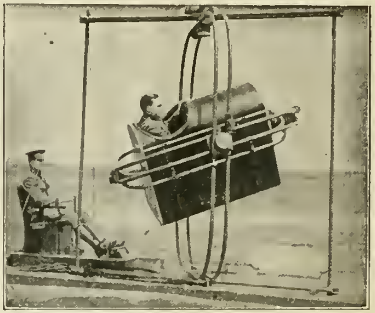

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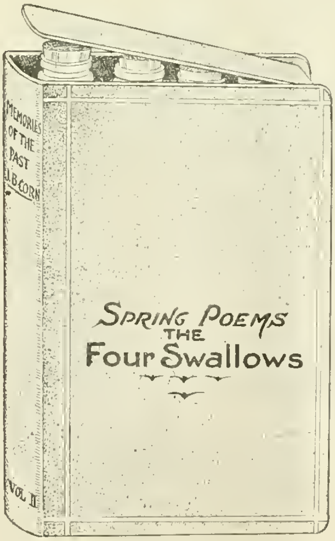

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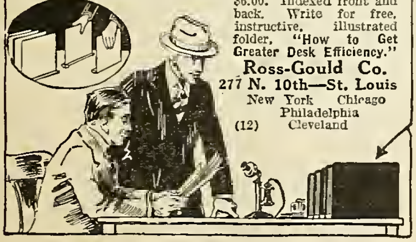

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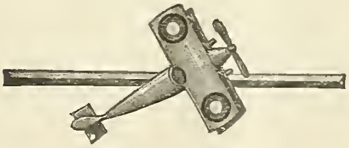

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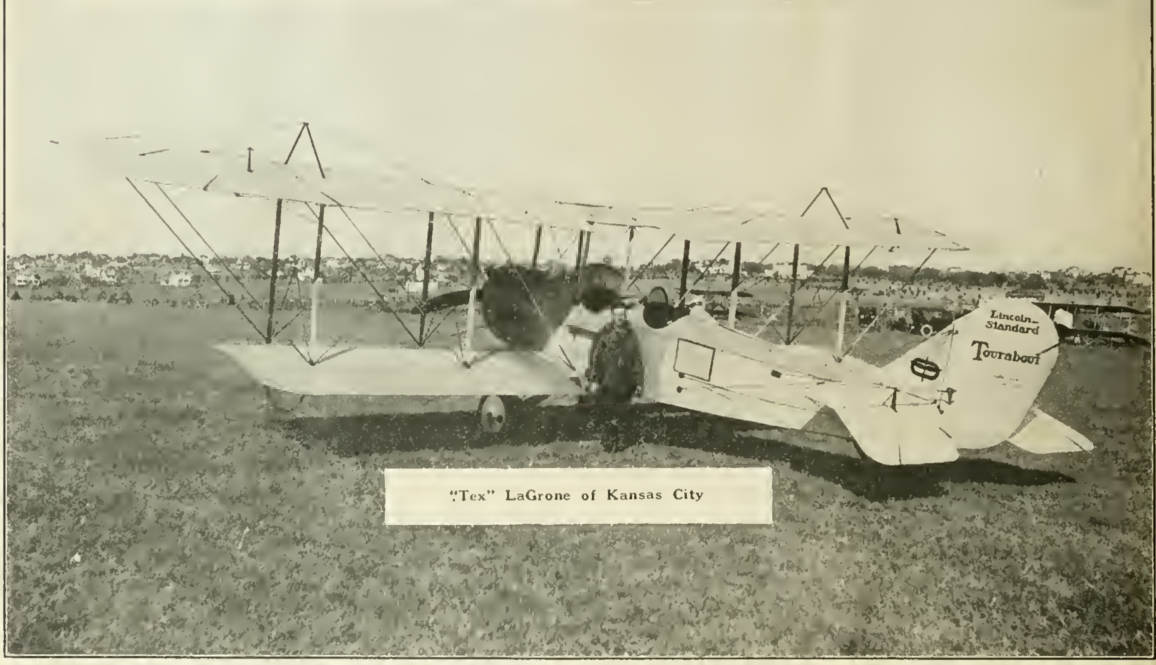

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By Ottorino Pomilio. 403 pages. 6 by 9. Illustrated. Postpaid $5.25.

This was the first book to be published in this country which presents in detail the application of aerodynamic research to practical aeroplane design and construction. Although the feat of flying in a heavier than air machine was first accomplished in America, the major part of experimental work in aerodynamics has been conducted in Europe. The Pomilios of Italy have had an important part in this experimental work. The data presented in this book should enable designers and manufacturers to save both time and expense. The arrangement, presentation of subject matter, and explanation of the derivation of working formulae together with the assumptions upon which they are based and consequently their limitations, are such that the book should be indispensable to the practical designer and to the student. [McGraw.]

Radio Engineering Principles

By Henri Lauer, formerly Lieutenant, Signal Corps, U. S. A., Assistant in the Preparation of Training Literature on Radio Theory and Equipment, and Harry L. Brown, formerly Captain, Signal Corps, U. S. A., in charge of the Preparation of the Technical Training Literature used in the Signal Service. 304 pages. 6 by 9. 250 illustrations. Postpaid $3.75.

This is the first book to bring the science of radio up to date—to include the wonderful developments made during the war. In no other book published in this country is there such complete information on vacuum tubes. About one-half of Lauer and Brown's "Radio Engineering Principles" is devoted to the discussion of the three-electrode vacuum tube, taking up its use as detector, amplifier, oscillator and modulator. The book covers thoroughly the operation and characteristics of two- and three-electrode vacuum tubes, the practical applications of the tubes, the generation and control of electron flow, and the conditions which must obtain to cause a tube to operate in any of its functions. Aeroplane and submarine radio theory is discussed in detail. Other special applications of the vacuum tube are also treated. Lauer and Brown's "Radio Engineering Principles" is the authoritative modern textbook on the subject. [McGraw.]

Standard Handbook for Electrical Engineers

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The "Standard" is the most widely-used electrical book in the world. It is quoted everywhere as the final authority on electrical engineering. It has been endorsed by the leading electrical journals here and abroad. It is an encyclopedia of electrical engineering. Its twenty-five thoroughly indexed sections cover every phase of the subject. The book is the work of more than sixty of the world's foremost electrical engineers. It has been called a triumph of engineering cooperation because of its completeness, its reliability, and its get-at-ableness. [McGraw.]

The Aeroplane Speaks

By H. Barber, A. F. Ae. S. (Captain, Royal Flying Corps). Postpaid $3.25.

Captain Barber, whose experience in designing, building and flying aeroplanes extends over a period of eight years, has written this book to be of assistance to the pilot and his aids. Lucid and well illustrated chapters on flight, stability and control, rigging, propellers and maintenance are followed by a glossary of aeronautical terms and thirty-five plates illustrating the various types of aeroplanes and their development from the first practical flying machine. An introduction presents, in the form of conversations between the various parts of the aeroplane, a simple explanation of the principles of flight, written, says the author, "to help the ordinary man to understand the aeroplane and the joys and troubles of its pilot." [McBride.]

Aeroplane Design

By F. S. Barnwell. With a Simple Explanation of Inherent Stability—By W. H. Sayers. With diagrams. Postpaid $1.10.

Mr. Barnwell, who is well known as a highly successful designer, holds a commission in the Royal Flying Corps. The section of this book written by him formed a treatise read before the Engineering Society of Glasgow University. Mr. W. H. Sayers in the second part of the volume elucidates a problem that has been the occasion of much discussion among mathematicians—that of inherent stability. Both sections are fully illustrated by diagrams. This book has been adopted by the U. S. Government as a text book for the instruction of aviators. [McBride.]

Aerobatics

By Horatio Barber, A. F. Ae. S. With 29 half-tone plates showing the principal evolutions. Postpaid $3.50.

This book by Captain Barber, whose earlier work, "The Aeroplane Speaks", is recognized as the standard textbook on ground work and the theory of flight, is an explanation in simple form, and for the benefit of the student, of the general rules governing elementary and advanced flying. Part I, which is headed "Elementary Flying", is an explanation of the essential elements of flight instruction from the moment the student enters the machine until he becomes a finished pilot. The mechanical control of the machine, straight flying, turns of all kinds, stalling, diving, gliding, slide-slips, and various ways of landing, flying through clouds, "taxying" and the first solo flight are described and analyzed fully and in non-technical language, each subject being taken up in progressive order. Part II explains the more advanced evolutions such as looping, spinning, the half roll, the complete roll, the Immelman turn, the falling leaf, the cart wheel, etc. The book contains a progressive syllabus of instruction, a glossary of technical terms and numerous advisory hints. [McBride.]

Flying Guide and Log Book

By Bruce Eytinge. With a Foreword by H. M. Hickam, Major, Air Service. 1921 edition, enlarged and revised to date. 150 pages. 4¾ by 7¼. 38 illustrations, including many photographs of landing fields, and a 24-page Pilot's Log Book for Machine, Motor and Flying. Cloth. Postpaid $2.75.

This book contains valuable information for the aviator, and also, for all those who are interested in, and helping to develop, commercial aviation. Contents.—Calendar. Identification. Frontispiece. Foreword. Past and Present (Poem). Introduction. Don'ts. Helpful Hints. Landing Field Report (Questionnaire). Airdromes—Landing Fields. War Department Orders: Specifications for Municipal Landing Fields. General Flying Rules to Be Observed At All U. S. Flying Fields. Cross-Country Flight Regulations. Rules of the Air. Flying Certificates for Pilots. Trouble Shooting in Airplane Engines. America's Aviation Facilities—Landing Fields (Alphabetically Listed Under Each State). Trans-Continental Aerial Mail Route. Air Routes (Round the Rim Flight). Pilot's Log Book for Machine, Motor and Flying. [Wiley.]

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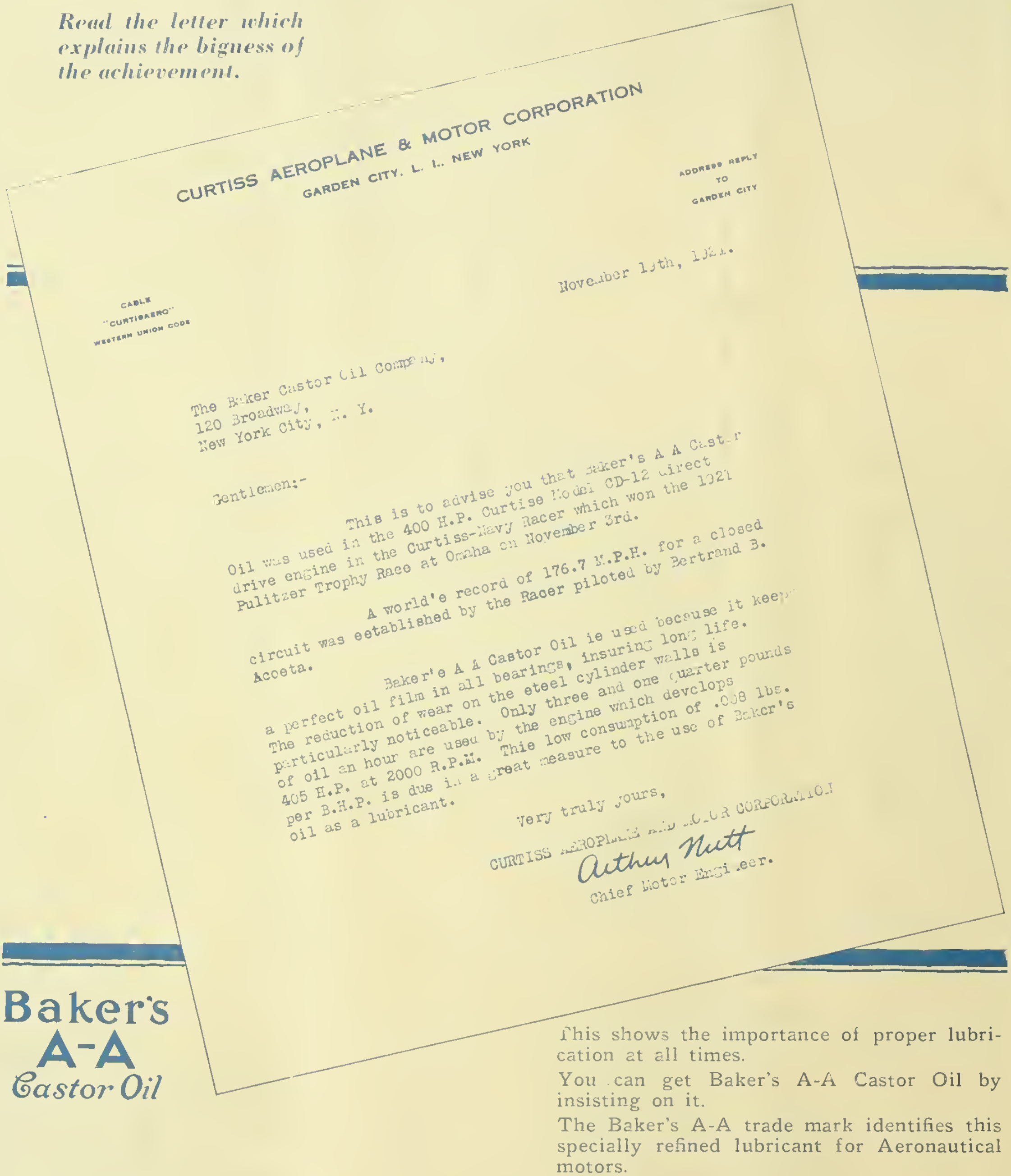

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WEEKLY

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Aeroplane Carriers An Issue At Limitations Conference

ISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
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December 5, 1921

AERIAL AGE
WEEKLY

VOL. XIV, No. 13

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Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.

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Aeroplane Carriers an Issue at Limitations Conference

AIRCRAFT took the place of submersibles November 19 as a principal topic of discussion among naval men who are here for the Conference for Limitation of Armament.

It was the new demand from Japan that she be placed on an equal footing with the United States and Great Britain—the other first-class naval powers—in the matter of aircraft carriers which prompted this shift in discussions from the murky depths where the submersibles lurk to ambush their prey to the blue air from which the warplanes launch their attacks.

It was predicted by naval men that when this new topic becomes a subject of conference discussion, as it necessarily must if Japan, as fully expected, should press her demand in earnest, it will introduce into the deliberations of the arms limitation conclave a topic involving what is, perhaps, the most vital principle underlying the present gathering of statesmen and military and naval experts.

Whether the bombing plane, which already, under tests conducted this summer by the American Army and Navy, has shown its destructive value in engagement with a capital ship, should be looked upon as a weapon of defensive or offensive character, would, according to naval men concerned in the deliberations of the conference, be a question calling for settlement in terms of precise definition. The question to be settled, in the opinion of naval men, is this: Is the aircraft carrier on par with the capital ship in destructive potentiality and is the limitation fixed in the American proposal, for that reason, to be as rigidly adhered to as the limitation relating to dreadnoughts and battle cruisers?

In the Hughes proposal the ratio governing future limitation in the tonnage of capital ships is carried right through, and in its practical effect, therefore, the aircraft carrier, though naturally classed as an auxiliary, is treated in the allotment of tonnage as though it were on a par with those big and powerfully armed vessels.

The Hughes proposal provides for an allowance in aircraft carriers of 80,000 tons each to the United States and Great Britain and 48,000 tons, or 60 per cent., to Japan. Japan feels that whatever allowance is given the two first named powers shall be allotted to her also.

American naval men declined to discuss the prospective demand of Japan, declaring it was a question that the conference must settle. The subject will bring another knotty problem before the subcommittee of naval experts, composed of some of the foremost men in the Admiralties of Great Britain, Japan and France and headed by Assistant Secretary of the Navy Roosevelt.

Among naval men in Washington for the conference opinion as to what ought to be done was divided. Many of the naval experts were reticent.

It was generally admitted, however, that aircraft carriers might be used as readily for offensive as defensive operations, the sole question involved being one of geography—whether they were used to ward off an attack in home waters or to carry abroad powerful war engines of the air for use in foreign waters.

"Of course," said one naval man, "an aircraft carrier having on board, say, twenty-five bombing planes and the necessary complement of projectiles, might be said to far exceed in potential capacity for destruction any capital ship afloat or projected at present. Aside from carrying capacity there is scarcely any limit to the size and destructive force of the projectiles such planes can launch from the air on a battle fleet or land fortifications. There is only this difference, that once their store of ammunition has been exhausted the planes are through, unless they can find a way of returning to the carrier and have it replenished. Experience has shown this to be a difficult and perilous operation. A battleship, on the other hand, has many rounds for heavy guns in her lockers."

One naval man of prominence expressed the opinion that the aircraft carrier was essentially to be regarded as a vehicle for offensive rather than defensive warfare. The American tests had shown that defensive operations could be carried on with more freedom and effect from a land base near the coast. The plane that sunk the *Ostfriesland,* it was pointed out in this connection, traveled 100 miles or more from her hopping off place to her target.

"If it is the dominant thought of the armament conference to make the navies of the future arms of defense rather than of offense, then limitation in the allotment of tonnage for aircraft carriers is quite as essential as limitation for capital ships of the large navies."

Japan at present is developing her air service with the aid of British experts. Of aircraft carriers she has at present in commission only one—a converted merchantman of some 9,500 tons. She has one prospective carrier of large tonnage already laid down, and two more are projected.

Great Britain during the war converted one of her fast cruisers of the *Furious* class—a thirty-five knot vessel—into a carrier of aircraft. Naval information shows that Britain has four aircraft carriers of the first line, with an aggregate tonnage of 67,200, and three of the second line aggregating 26,130 tons. Her building program includes three first-line and three second-line carriers of aerial craft.

The United States had planned two aircraft carriers of the most modern and efficient type and of high speed, to cost $35,000,000 each, but Congress refused to appropriate the money. The best Congress would do was to give sufficient money for the refitting of the naval collier *Jupiter,* which has been renamed the *Langley,* and fitted for the carrying of aircraft to be used in naval operations. She is only 12,700 tons, has a speed of only fifteen knots and is pronounced by the naval experts entirely inadequate.

The Aircraft Problem

As might have been expected, Admiral Sir Percy Scott, who pronounced the doom of the capital ship in 1914, has only one comment to make upon the American proposals to limit naval armaments: "The principal matter is whether we shall build more warships or not. Owing to the changed conditions of naval and aerial warfare, building battleships is a policy of the insane." In the British Admiralty's "Notes on Naval Policy," published eighteen months ago, it was said that the role of aircraft was "that of an auxiliary and not of a substitute for the capital ship," which was declared to be "the unit on which sea power is built up." Nevertheless: "It is possible to foresee tremendous developments in the air which may revolutionize eventually our present conception of sea warfar and sea strategy." This admission was made by the British Admiralty early in 1920.

A few months later the German dreadnought Ostfriesland, a spoil of war, was sunk by bombing army (not navy) aeroplanes off the Virginia Capes. Other surrendered German warships, including a cruiser, were also sent to the bottom. In a report of the tests General William Mitchell contended that "had the army air service been permitted to attack as it desired, none of the seacraft would have lasted ten minutes in serviceable condition. The first provisional air brigade could have put out of action the entire Atlantic Fleet in a single attack." Like Sir Percy Scott, General Mitchell fires off his convictions in broadsides. Both insist that the future of the navy will be in the air. Rear Admiral W. F. Fullam, retired, has said of the sinking of the battleship Alabama by army Martin bombers on Sept. 26, 1920: "It is childish to attempt to discount this result by saying the Alabama was an old ship. No modern dreadnought could have survived the attack."

The revolution of "our present conception of sea warfare and strategy" (to quote from the naval notes of the British Admiralty) having occurred, there was a lively interest in what would be found about aviation in the proposal of the United States for a limitation of naval armaments. It was very little, merely this: "The limitation of naval aircraft is not proposed." The following note was appended: "Owing to the fact that naval aircraft may be readily adapted from special types of commercial aircraft, it is not considered practicable to prescribe limits for naval warfare." But it was recommended that "the total tonnage of aeroplane carriers shall be as follows: United States, 80,000 tons; Great Britain, 80,000 tons; Japan, 48,000 tons." So an attempt was made to limit the number of planes that could be used as auxiliaries to the fleets of the three sea Powers.

If Sir Percy Scott and General William Mitchell are right about the menace of the bombing aeroplane, the nation that possessed a marked superiority in commercial aircraft over other nations could become, if it manufactured explosives on a large scale, the most formidable sea Power, provided it quickly improvised swift aeroplane carriers. The nation that neglected commercial aviation would do so at its peril. Probably more advanced in the use of aircraft for transportation than any other country is Germany, in spite of the inhibitions and safeguards of the Treaty of Versailles. Germany has many commercial air services today linking its cities. Already this year more than six thousand passengers have been carried on the regular routes. Visitors to Berlin may fly for two hours in the suburbs for 200 marks, or less than a dollar at the present rate of exchange. Few things are more common in Germany than aeroplanes, parked and in the sky. Many of these machines could be easily converted to military uses. Both France and England have a considerable superiority over the United States in commercial aviation. Japan lags in the competition, but aims to excel.

The United States has not only been slow to manufacture aeroplanes for commercial purposes, but has been backward in providing the navy with fast carriers. Obviously for its own interests the problem of limiting naval aircraft should be grappled with at the Washington conference. The alternative should be the rapid development of commercial aviation.—*N. Y. Times.*

THE NEWS OF THE WEEK

Flies 197.8 Miles an Hour In Navy Racer

Bert Acosta, piloting a Curtiss navy racer, at Mineola, November 22, broke the American speed record for aeroplanes by making an officially timed average speed of 184.8 miles an hour. The maximum attained on the flight, as checked by electric timing apparatus, was 197.8 miles an hour.

The test was officially observed by the Aero Club of America through Caleb Bragg, chairman of the contest committee. The timing device was operated by R. A. Leavell, of Chicago.

The flight was the first to be made under the rules of the Federation Internationale Aeronautique in this country since the war. Under these rules Acosta made eight flights over the measured course of one kilometer, four with the wind, and four against.

The previous American record was established last fall by Captain C. C. Moseley in the Army Air Service Verville-Packard biplane. This flight, however, was not made under the F. A. I. rules, but was officially set down as 186 miles an hour. Under the same system Acosta's time yesterday would have been 197.8 miles an hour.

The Roma in Test Flight

Newport News, Va.—The semi-rigid airship Roma, purchased from Italy by the United States, made her first test flights November 15, remaining in the air nearly four hours.

Officers at Langley Field, where the Roma was assembled, described the flight as most successful.

Baltimore to Have Big Aero Meet

A committee composed of members of the American Flying Club and the Maryland National Guard organizations has completed the plans for one of the largest aviation meets and exhibitions of aircraft ever held in the East. The date set is Sunday, December 4, and arrangements are being made to handle a record crowd. The meet will be held at the municipal flying field at Dundalk, which has been recently officially named Logan Field in honor of the late Lieut. "Pat" Logan of the Army Air Service, who was killed there during the aviation meet last year.

The committee in charge of the exhibit has been most fortunate and is assured of a large number of the latest military and commercial types of planes. It is expected that there will be twenty-five or thirty planes on the field for the meet. Brig. General William Mitchell of the Air Service, whose marvelous organization of bombers proved conclusively to the world that the most approved type of battleship heretofore considered practically impregnable could be sunk in a few minutes by bombs dropped from aeroplanes, is sending some of the officers who participated in the bombing and their planes to show Baltimore what a real modern bombing plane looks like. Besides the "bombers" the Air Service is planning to exhibit several other types of pursuit and speed planes.

The commercial exhibits will be second in no way to the military exhibits and will include everything from the tiny aerial runabouts to the large air liners with their closed-in cabins and large comfortable lounge chairs. These commercial planes represent the latest in the development of aerial navigation and include the best known European and American types.

In spite of the fact that a large number of the exhibits are coming from other cities, Baltimore will be well represented in the air by the 1st Observation Squadron of the Maryland National Guard. This organization, commanded by Capt. P. V. Burwell, is composed of one of the keenest groups of ex-service pilots in the country. It was through their spirit and enthusiasm and the untiring efforts of Major Geo. L. Jones that the squadron was organized and is today the only National Guard outfit in the country that actually flies. The Squadron has its own planes and will give exhibitions in formation flying, combats, bombing and acrobatic flying.

Both the officials of the Flying Club and the officers of the Guard want to make it plain that the meet is to be of an educational nature and not a circus affair, and for that reason admission to the field will be free. The general public little realizes the progress made in aviation during the past few years, both in this country and abroad, and of the two worlds the old seems to have surpassed us in the matter of efficient design. There will be at least two types of European planes at the exhibit capable of carrying six passengers with the same amount of power that was used during the war to carry one in a small scout plane. This is just one indication of the early arrival of commercial aviation on a paying basis.

Turkey Goes by Plane to be Harding Dinner

Chicago.—Wearing an aviation helmet and goggles and clad in a black and gold sweater held on by a pink bow, "Supreme II," a thirty-nine-pound turkey, was placed on board an air mail plane at Checkerboard Field November 21 bound for Washington, where the bird will be killed to supply Thanksgiving Day dinner for President Harding.

The turkey is being presented to the President by the Harding Girls Club of Morris & Co., packers, and is the second to be sent to President Harding by the club. The girls knitted the turkey's sweater.

The departure of the turkey was accompanied by considerable pomp. A detachment of United States Marines accompanied it on the trip to the field, and the plane had to be considerably altered to make room for the big bird's crate.

Dr. Nichols Retires from M. I. T.

Cambridge.—Dr. Ernest Fox Nichols has resigned the presidency of the Massachusetts Institute of Technology and his resignation has been accepted by the executive committee of the corporation.

His decision resulted from the advice of his physicians that the illness which followed immediately upon his inauguration on June 8 last had resulted in "certain physical limitations, some of them probably permanent," which would make it unwise for him to assume the responsibilities of the position.

Deafness Partially Cured by Plane Ride

Spokane, Wash.—Total deafness following scarlet fever in childhood was partially cured by an aeroplane plunge in the case of Miss Esther Devlin, aged 20, of Spokane. The young woman was taken to an altitude of 13,000 feet in a U. S. Corporation machine, piloted by N. C. Mamer. The aeroplane was put into a nose dive and dropped 10,000 feet. For the first time in 13 years the young woman heard sounds. The whistling of the wind in the wings and guys was first audible, followed by the roar of the engine. Miss Devlin had first removed her helmet. On landing she was able to hear the pilot's voice. The cure was not complete, however, and another attempt will be made. Physicians asserted the girl's only hope for a cure was through shock. The full effect of the long plunge was not secured, for the reason, it was asserted, that Miss Devlin enjoyed the experience immensely and no contributing element of fright was developed.

California Club to Hold Aviation Ball

The Aero Club of Southern California has made arrangements for an aviation ball at the Ambassador Hotel, Los Angeles, on December 8, and the function promises to be one of the most important events of the social season in that city.

The officers of the club are as follows: S. M. Spalding, pres.-treas.; K. M. Turner, 1st vice-pres.; John H. Fisher, 2nd vice-pres.

The directors are S. M. Spalding, K. M. Turner, John H. Fisher, Frederic Whitney, John B. Miller, A. R. Peck, Albert Lee Stephens, J. A. Jevne, Lee A. Phillips.

Sunday School Aeroplane Race Across Continent

From Langley Field to San Francisco by aeroplane! And a race at that! That is what the members of the Langley Field Sunday School are taking part in with all the enthusiasm and daring of a race across the continent by their daddies in the Air Service.

Each class has chosen a type of aeroplane or airship in which it will undertake the long journey. The Roma, Thomas Morse, Lepere, Martin Bombers, Fokkers, and others are competing for first honors. Attendance of all members of a class at any one session counts an advance of one hundred miles, while for each member present a proportionate number of miles are achieved. A new member counts two hundred and fifty miles for the class securing such, while the highest average collection counts fifty miles advance. There are also forced landings. Such for example is the case when a scholar is late to school; his class has a forced landing and loses twenty-five miles. Serious forced landings also occur for bad behavior, the class having such a member being set back fifty miles for each offense.

But the contestants claim that their planes are in excellent flying condition and no forced landings are anticipated.

A generous prize will be awarded the winners, while each member of the winning class will receive a memento of the contest.

Flying Auto Demonstrated

Paris.—A flying automobile is the latest development in the French aero world.

A successful demonstration of an ordinary automobile with folding wings, two engines, one of ten horsepower for land going and the other of 300 horsepower for air travel, was held at Buc, Seine-et-Oise. The machine performed all the usual feats of an aeroplane and also of an automobile.

First Rarefied Air Dirigible to America

The world's first dirigible using rarefied air instead of dangerous explosive gases probably will become the property of an American syndicate, according to the Paris correspondent of the New York *Herald*, as soon as M. Bossi, representing the Zorzi Corporation of New York, arrives in New York to conclude details in behalf of the contractors of the dirigible, a French engineer named Vaujean and an Italian constructor named Garciulo.

M. Bossi sailed on board the *Orduna*. He is taking a small model which has aroused the keenest interest among aerial navigators. After ten years of experimenting Vaujean and Garciulo devised an apparatus consisting of three concentric envelopes in an aluminum compound all covered with heavy aeroplane textile and held in their places by steel wires. The power is obtained from four motors, each controlling a propeller. It is estimated that the dirigible can carry ninety passengers besides a crew and supplies sufficient for an eighteen-hour flight at a speed of seventy-five miles an hour.

Art and Aeronautics

We have pleasure in presenting the following information to our readers:

"I shall esteem it a great favor if you will be kind enough to publish this letter for me, as I wish to make known the fact that my artist friend, Mr. Robert Hunter, A. A. A. (Member of the American Art Ass'n of Paris and instructor in several leading art schools) had finally agreed to work mutually with me.

"Mr. Hunter is an American artist very famous in Europe (Paris especially) and this country, he is now back in New York and together we intend to bring art into the aviation business and aeronautical art into the homes and clubs of all persons who are enthusiastic about aviation, later into the home of 'outsiders,' incidentally forwarding interest in aeronautics. I venture to say that we are entering a virgin field. We are optimistically and sincerely hoping that we shall have support from everyone interested in aviation, from the individual to our largest aircraft manufacturers. Orders, no matter how large or small, will be promptly executed.

"It might not have occurred to many followers of aviation that aeronautical art can be introduced into their home to beautify it. Xmas and the New Year are near. We are willing to produce aeronautical art objects in the way of panels, screens, lighting effects and paintings of aviation scenes which will include portraiture in such cases, when necessary, on order. All these would make very acceptable holiday, Xmas, New Year or general gifts. What aviator would not be delighted to receive an oil painting of 'the type he flew on service' for an Xmas gift with him seated in the cockpit. With knowledge of the type he flew and a good photo of him we provide these.

"In opening up this new field *only works of quality* will leave our studio. Work will be done as ordered, i. e.—in oils, water colors, black and white or silhouette. I, as an aviator who has flown almost every type of service plane, promise that all our aeroplane paintings will be exact in all detail, absolutely to scale and be marked with Squadron markings if necessary. We invite correspondence regarding the above to me at 64 W. 70th St., New York City.

"(Signed) R. J. SMITH."

To Use Air Trade As Basis of Quotas

Washington.—Specific new agencies of warfare are now being considered by subcommittees of the committee originally appointed by the Limitations Conference to deal with land armaments. The subjects of aircraft and gas are being considered by separate sub-committees.

It was stated November 25 that the committee considering aircraft was working on three general principles—quantity, character and use. On the first, it is understood the basis for determining each nation's quota in peace time will be the progress which commercial aviation has made in that country.

As for the second point, there are certain types of planes frankly built for use in war. Among these are planes of the JL-12 type, of all metal construction and armed with twenty-six machine guns for use against infantry and two against other aircraft.

It is said the third point must be looked upon from the viewpoint of the second, so that this will be governed by decisions regarding the character of planes to be built.

It is believed that both the American and British delegations will oppose any attempt to put a limit on the use of gas, because Germany has the largest gas plants in the world. In addition it is felt such limitation would handicap the technical industries.

A Good Example for Others to Follow

Evincing their interest in aeronautics, the Peerless Manufacturing Company of Norristown, Pa., made an official request for information from the Army Air Service on the markings for Norristown, stating that they will be only too glad to place these markings on the roofs of their buildings.

The AIRCRAFT TRADE REVIEW

The Truth About Commercial Aviation

There has been on the topic of aerial transportation so much false optimism on one hand and so much needless pessimism on the other that the average person is somewhat bewildered as to whether aviation is coming or going.

A progress report is needed on the status of commercial aviation, but this report to carry weight must be by a competent authority.

Engineering might be called the silent profession from the reticence with which its members conduct themselves in the discussion of topics of public interest. When engineers speak, therefore, it may generally be assumed that the opinions put forth are derived from a careful study of actual figures and facts.

The Society of Automotive Engineers, whose membership of 5,000 is composed of many of the foremost engineers, and which includes in its ranks a large number of aircraft designers, will hold a series of meetings through its Sections in several cities during the next month at which various speakers will tell what has actually been done both here and in Europe in the way of commercial aviation. Authoritative figures will be given showing the number of planes now in operation, the number of miles flown during the past year, the percentage of successful flights and the number of accidents to planes attending to business as contrasted with the much greater loss of life and limb caused by spectacular stunting or through the use of imperfectly designed machines or the operation of planes by insufficiently trained pilots.

The cost of aerial transport per passenger-mile and per ton-mile will be given. These figures will be obtained from flights that have actually been made on regular schedules both here and abroad.

Reports indicate that the machines of one foreign manufacturer during the past summer made 693 out of 725 trips scheduled; over 95 per cent. More than 160,000 miles was flown with no accidents whatever to cargo or passengers.

The annual report of our own Air Mail Service involves a much greater mileage. Of 7,659 trips planned, 7,081 were perfectly completed, or 85 per cent. Nearly half of the flights were made under bad weather conditions. A million and a half miles was flown and about 45,000,000 letters were carried.

After recounting what has been done to date, those scheduled to give the talks at the various meetings will discuss what problems are still to be solved. Subjects that will receive attention in this connection are airways, landing-fields, ground organization, legal aspects, radio and meteorological service and the relation of civil aviation to national defense. In connection with this last subject moving pictures will be shown of the recent aerial bombing operations against the surrendered German battleships. These pictures have not previously been shown publicly.

Those who will take part in this national program include J. G. Vincent, conspicuously identified with the Liberty engine; representatives of the Army and Navy Air Services; Glenn L. Martin, one of the pioneers in aviation; Ralph Upson, balloon expert, and Assistant Postmaster General Shaughnessy, who will give real information about the Air Mail Service.

The following dates have been fixed definitely:

St. Louis, December 1; Indianapolis, December 6; Worcester, Mass., December 9; New York City, December 15; Cleveland, December 16; Philadelphia, December 22.

Other meetings will be held during the month at Cincinnati, San Francisco, Buffalo and Detroit.

Six Big Factors In Flying Safely

There are engaged in commercial flying in the United States about 1,200 aircraft, according to a report prepared for the Department of Commerce by the Manufacturers' Aircraft Association. This report is based on the most trustworthy information obtainable, and a conservative estimate places the mileage flown by these commercial machines in the first six months of the present year at 3,250,000 miles, and in that period there were forty serious accidents in civil flying, the computation not including accidents to Government-owned machines, resulting in the death of fourteen persons and more or less serious injury to fifty-two others. In eighteen of the accidents there were no casualties, the fourteen deaths being charged to ten accidents and the fifty-two injuries to forty accidents.

The report as made public by the Information Group of the United States Army Air Service enumerates the requisites for safe flying as six in number. They are:

1. A machine sound aerodynamically and structurally.
2. An engine of sufficient power.
3. A competent, conservative pilot and navigator.
4. Air ports and emergency landing fields sufficiently close together to insure gliding to safety.
5. Nation-wide weather forecasts specialized and adapted to the needs of fliers.
6. National air-route charts.

"Each of the forty accidents," says the report, "was caused by deficiency in one or more of the above elements. Seventeen were attributed to the pilot, perhaps through carelessness, perhaps incompetence, perhaps bad judgment, combined with other factors. There is no doubt that a good pilot can guide a poor machine to safety with greater chance of success than a poor pilot can operate a first-class machine. Therefore, at the very top of the list of Government needs is placed the examination and licensing of pilots.

"During the war more than 17,000 young men were trained to fly. The art of flying cannot be retained perpetually without regular examination. Ten attained a high degree of competency without regular examination. Ten accidents of those given are attributed to inadequate landing fields or to the total lack of landing facilities. During the war the Army and the Navy acquired many terminals, most of which have since been abandoned. The fragmentary remainder has been slightly added to by the air mail, municipalities and private enterprise, but the United States is today woefully lacking in air ports for even the 1,200 craft in operation.

"A survey made by the Manufacturers' Aircraft Association discloses that in the United States and its possessions there are only 271 land and water air terminals, many of them concentrated in certain localities. Of the 271 listed air ports, 145 are controlled by municipalities, 69 are privately owned and the others are a part of the Army and Navy Air Service and the air mail.

"While only two accidents are attributed to the lack of weather reports and two to the lack of clearly defined routes or limitations in traveling between or over cities, it is certain that aerial transport cannot develop until these factors are met. As an illustration, two of the worst accidents in our flying history are attributed to these causes. As one was naval and the other military, they cannot be included in the civil table, although in their results they were as harmful to civil flying prospects as though they had occurred to private individuals.

"Equal in importance with learning the qualifications of pilot and navigator is inspection of aircraft and engines. But of the forty accidents, eleven may be attributed to faults which proper inspection would have revealed—three concerning the plane, six the engine and two an accessory. In many instances it is found that the engine is blamed when realy it is an accessory that is at fault. An analysis of the Pulitzer race last year proved this. When it is remembered that operators of motor cars are required to qualify and that motor cars are periodically placed under rigid inspection, it is astonishing to learn that any one can take any sort of flying machine into the air at the present time, with the consequent peril not only to himself and his passengers, but to many persons below.

"Eight of the forty accidents occurred during stunting. In these eight accidents seven persons were killed and twenty-six injured—exactly 50 per cent. of the total. In other words, stunt flying in unrestricted areas was responsible for as many casualties as all other elements combined. While stunt flying is necessary to testing and essential to warfare—and it is believed advisable that all pilots know how to stunt, so that in case of an emergency, when only a stunt will save their craft, they will be able to act quickly, with understanding and without fear—the habit of stunting for thrill is dangerous, fatal in many instances and always harmful to civil flying. A governmental system of control limiting stunting to certain areas will meet this unfortunate menace to aeronautics.

"Two accidents were reported through carelessness on the field. In one notable instance the pilot, in order to avoid the crowd which surged out in front of his machine as he was taking off, deliberately wrecked his craft. It is observed that at every flying demonstration, even at locally policed fields, the spectators ignore warnings and must be forced to keep back. Only Federal rules, rigidly enforced, will meet this situation.

"Finally, five accidents are attributed to 'unknown' causes. The hope of preventing accidents depends on learning—then correcting—the cause of each. It is evident Government authority is required to obtain information in such cases."

AN INVESTIGATION ON THE EFFECT OF RAKED WING TIPS

By F. H. NORTON

Langley Memorial Aeronautical Laboratory

Summary

This investigation was carried out by request of the United States Air Service in the wind tunnel of the Massachusetts Institute of Technology. The results are here published by the National Advisory Committee for Aeronautics as it is thought that they may be of general interest. Wings of the R. A. F. 6 section are tested with various angles of rake, and it is found that although rake has very little effect, a positive or negative rake of 30° is the best.

Introduction

There has been very little work done on the careful investigation of wing tip forms. For this reason the present test was carried out to investigate the influence of rake when the aspect ratio is held constant. The angles of rake tested were 0° ± 20° ± 40°. A greater angle of rake than this would be structurally impractical. Only lift and drag runs were made.

An investigation of rounded wing tips has been made by the British Advisory Committee (T.477) and some work along this line has been done by Eiffel.

Methods

A short section of an R.A.F. 6 wing was fastened to the crank spindle of the N. P. L. balance and the various tip sections (Fig. 1) were pinned onto the ends of it. Due to the use of the crank spindle the drag readings are too low, but as only comparative values were desired no corrections were made.

Precision

As the differences between the various rakes were small, each set of wing tips was set and run three separate times, and the mean values taken. The precision is everywhere better than one per cent.

Results

The lift, drag and L/D are plotted in Figs, 2, 3 and 4, for various angles of rake. It is evident that the efficiency increases slightly with rake up to about 30° and then decreases, while the lift increases rather rapidly at large positive rakes. The increase in L/D at 4° incidence by using a 30° rake, as compared with a square tip, is about 7%.

Conclusions

It may be concluded that the effect of rake on the lift and drag are so small that considerations of strength and aileron efficiency should govern the wing tip form.

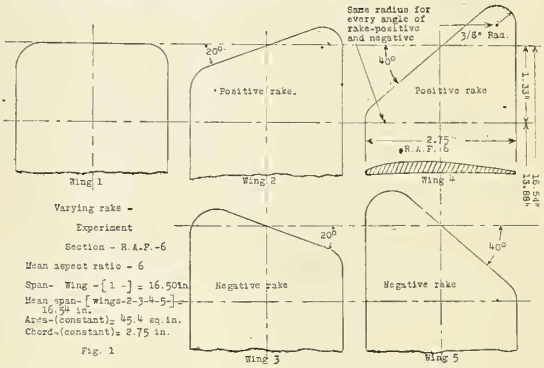

Fig. 1

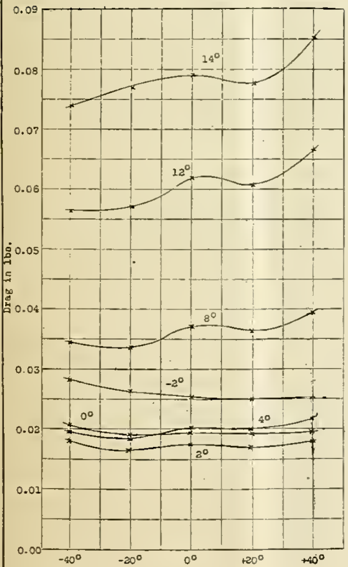

Fig. 3.

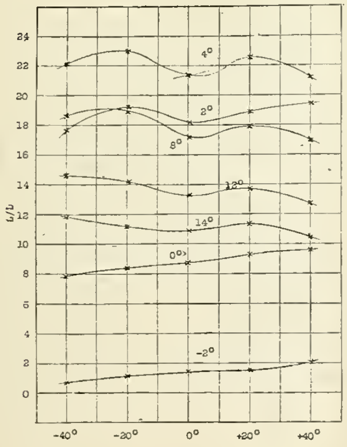

Fig. 4

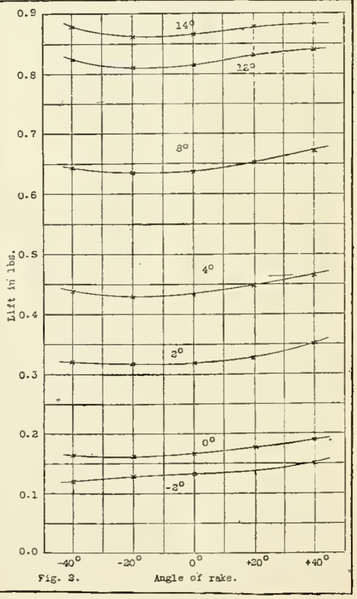

Fig. 2.

ESTABLISHMENT OF AVIATION SCHOOLS

By ERICH KEMPE*

IN the establishment of aviation and other technical schools, the greatest difficulty is to obtain suitable teachers. In selecting them, the highest standards must be maintained. It need not be thought that aviation experts will do. Good aviators and mechanics are mostly poor theorists and instructors. Mathematics and theoretical principles can not be taught by an aeroplane pilot who is not an actual professional mathematician. Instruction in assembling and making models may be given by practical mechanics, but this must be under the supervision of a professor, so that theory and practice may be combined.

The object of the instruction in aviation schools should not be to produce aviators, as such, but efficient constructors and thinkers. Flying can be quickly learned at any time, either in connection with the school or related industries.

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* Translated from "Flug-Woche," by the National Advisory Committee for Aeronautics.

The whole course of instruction may be conveniently divided into several courses, semesters or years, according to the aims of the institution. If practical aviation is to be taught in the institution, it would be better to leave it till near the end of the entire course.

The subject should be made attractive to the student, however, even during the first year. It is a good plan to take up the historical material, which will furnish entertainment for many a lesson and thus form an agreeable diversion from the dry and difficult material of the elementary subjects.

I have been very succesful on these lines in the Nuremberg aviation school. We have always been limited in the choice of subjects in Nuremberg by the fact that our pupils have been only graduates of the elementary public schools. For more advanced students certain courses (for instance, in mathematics) could be replaced by courses in manual training.

In Nuremberg, the course is divided into four years of eight months, with 12 to 16 work hours per week. By increasing the hours per week, the whole course might be divided into several semesters or quarters with a minimum of not less than three semesters.

First year: descriptive geometry and elementary aeronautic drawing (2 hours per week), history (1), mathematics (4), technics of building materials and fuels (1), elementary aircraft instruction (1). Mathematics and descriptive geometry are absolutely indispensable, if a fitter or technician is to understand his aeroplane or airship thoroughly. Aside from these required subjects, there are the following electives: German and bookkeeping.

Second year: construction (2), mathematics (2), trigonometry (2), physics (1), elementary engine course (1), mechanics and strength of materials (3), elementary aircraft course (1), electricity (1), practice in assembling engine.

Third year: mathematics and statics (2), engines (4), technical aircraft course with construction (3), manufacturing (2), practice in assembling finished engine.

Fourth year: construction and practical exercises on large gasoline engine (4), making giant aeroplanes and balloons (3), aerodynamics, differential calculus, goniometry, meteorology (each 1), making models and gliders with practical instruction in flying, in the first three years compulsory (4).

The courses in descriptive geometry, mathematics, trigonometry, strength of materials, mechanics, electricity, etc., contain what is ordinarily taught in mechanical engineering, but with special application to aviation. On the other hand, the following are purely practical subjects: technical manufacturing, engine courses I and II, aeroplane courses I and II, technology and history. To many people history seems superfluous, but I have not found it so. In the first place, I have learned that the history of the evolution of aviation, with all its interesting stories, like King Bladud, Kaspar Mohr von Schussenried, etc., may be regarded as "sweetening" for the more difficult courses. The eyes of the pupils, older as well as younger, never brighten more than when listening to the recital of these stories. And it is not important to explain with the aid of photographs and sketches the origin of the Montgolfiere and Giffard balloons or the flying machines of Oliver von Malmesbury, G. B. Danti, Leonardo da Vinci, Cayley, Lilienthal, etc., and to show, for example, to what circumstances we are indebted for the modern aeroplane with its rudder and ailerons and other special features? A knowledge of the evolution of the many kinds of balloons and flying machines is essential for the general understanding of flight technics. Anyone taking it seriously has sufficient material for a lesson a week for a year.

The technology of building materials and fuel is divided into chemical and mechanical technology with especial reference to aeroplanes.

The aircraft course is an important one and is divided into elementary and technical courses. The former is subdivided into airship and aeroplane courses. In connection with airships, the course comprises examples of airship calculations, analytical determination of air resistances, expansion, radius of action, insulation, etc. In connection with aeroplanes, individual types, gliding flight, construction, landing gear, fuselage, equipment, etc., are taken up. The technical aircraft course comprises calculation and construction, representation of various forces: thrust, lift, etc., determination of aerofoil shapes, stabilizing, calculation of curves, straight flight, propeller, etc. This course is largely illustrated by original models. The manufacturing course gives an insight into manufacturing, riveting, splicing, autogenous welding, pipe connections, stretching, gluing, sewing, etc. The most important course of all is the one on engines. This is systematically carried out by engine specialists, in calculation, construction and assembling, so far as it concerns practical operations. In all the courses, emphasis is laid on practical exercises, like assembling and dismantling of actual aeroplanes and especially engines, and making drawings.

The equipment is a very important factor. The library should be complete, including all old as well as new works. There should be models of complete aeroplanes and of special parts, engines and instruments for inspection. Review lectures, illustrated by pictures, should be given every month. In the model shops, there should always be kept an abundant supply of materials for making models of all kinds and sizes. Every school year should close with visits to aircraft factories and laboratories, as likewise with competitive flights of models, with distribution of prizes.

ANEROID INVESTIGATIONS IN GERMANY

Abstract of Paper Entitled "Uber Aneroide," by E. Warburg and W. Heuse, Physikalisch-Technischen Reichsanstalt, Zs f. Instrumentenkunde 39:41-45, 1919

Prepared by M. D. HERSEY

Massachusetts Institute of Technology

FOLLOWING an historical review of aneroid development, in which the work of Chree is emphasized, the authors state:

"It would therefore seem well worth while to undertake, through some suitable improvement of the aneroid, to diminish the width of the hysteresis loop sufficiently to make the errors resulting from it practically negligible."

To discover the origin of the loops, experiments were made similar in purpose to the "vivisection experiments," so-called, which were made at the Bureau of Standards and referred to in the Physical Review, 6:75-77, 1915, article entitled, "Aneroid Barometers."

Concluding that the trouble is not in the steel spring, but rather in the diaphragm, a theoretical study is made of the equilibrium of forces acting on the vacuum box. After setting up the fundamental equation of equilibrium

$$T = T_o + f\ z$$

in which T denotes the tension pulling upward on the vacuum box, T_o its initial value when the downward deflection of the box is $z = o$ and when the air pressure p has its standard value p_o; and in which f is a stiffness constant for the spring—the authors proceed to elaborate the terms of this equation by reference to the theory of elasticity.

Two cases are considered—first, that of a thin, flat diaphragm undergoing a deflection which is quite small compared to its thickness; second, the opposite extreme case when the deflection of the diaphragm is quite large compared to its thickness.

The first special case enables us to consider that only shearing stresses normal to the diaphragm exist, radial tensions being neglected. The other extreme case makes just the opposite assumption, namely, that the only stresses which need to be considered are tensions parallel to the surface of the diaphragm. After carrying through the theory of both cases as far as possible, the authors abandon the equations so deduced in favor of empirical observations. Nevertheless, some tentative conclusions are reached which are interesting.

Thus, for the flat diaphragm undergoing only an infinitesimal deflection, the following equations are derived from the theory developed by Goeppl, Vorlesungen uber technische Mechanik, 3:255, 1897: 5:110, 1907:

$$\left.\begin{aligned}
s^2 &= s_o^2 - \frac{8\ a\ z}{p\ \rho^2} \\
T &= \pi\ p\ s_o^2 - \frac{p\ \pi\ a\ z}{\rho^2} \\
s_o^2 &= \frac{\lambda^4}{\rho^2} \\
\lambda^4 &= \frac{1}{4}\ (r_2^4 - r_1^4) - r_1^2\ r_2^2 \log \frac{r_2}{r_1} \\
\rho^2 &= r_2^2 - r_1^2 - \frac{4\ r_1^2\ r_2^2}{r_2^2 - r_1^2}\ (\log \frac{r^2}{r^1})^2 \\
a &= h^3\ E \frac{m^2}{6(m^2 - 1)}
\end{aligned}\right\} \cdots\cdots\cdots\cdots 2$$

In these equations, to begin with, s denotes the radius of a disk such that the force acting on it due to the pressure p will just equal the actual tension T, and s_o is the value which it has for zero deflection. The symbols α, ρ and λ employed in the first three equations are defined by the last three equations. (In the original text, P is employed for the tension; and the latter a, in German type, appears instead of our α). Further, h = thickness of diaphragm, E = modulus of elasticity and 1/m = cross-section contraction/longitudinal strain.

The authors explain why s_o is approximately equal to $(r_1 + r_2)/2$ where r_1 and r_2 are respectively the inner and outer radii of the annular diaphragm.

An original feature of the authors' contribution now appears in their statement that when the deflection is zero, the distribution of load between the rim and the central solid disk is independent of the elastic constants of the diaphragm, and the performance of the instrument momentarily independent, therefore, of elastic after-effect when passing through the position $z = o$. Conversely, if z is different from o, then, as a result of the term $\frac{8 \pi \alpha z}{\rho^2}$ which now enters, T and with it the distribution of air pressure between the rim and the plate will depend on the elastic reaction of the diaphragm. If, for example, the pressure is changed from p^o to a higher value p, the plate deflects inward, z takes on a positive value, and the elastic reaction of the diaphragm diminishes the proportion of the air pressure which falls on the plate. If any reaction diminishes because of elastic after-effect, then the plate will again be more heavily loaded and will continue its inwardly directed motion.

That part of the elastic reaction of the diaphragm which depends on z is, according to equation (2) independent of the pressure p, remaining, therefore, unaltered in magnitude for zero pressure.

If one substitutes into equation (1) the value of T obtained from equation (2) and takes account of the fact that, according to the equations (2)

$$T_o = \pi \; p_o \; s_o^2 \tag{2a}$$

one finds for the sensitivity of aneroids with very small pressure changes

$$\frac{z}{p - p_o} = \frac{\pi \; s_o^2}{f + \frac{8 \; \pi \alpha}{\rho^2}} \tag{3}$$

The aneroid diaphragms used were made of .02 cm. thick German silver for which, with $1/m = E = 11 \; 10^5$ kg/cm, $\alpha = 1{,}7$.

From equation (3) it is evident that the influence of elastic after-effect on the indication of an aneroid in the contemplated case diminishes with diminishing thickness of the diaphragm, and with increasing spring constant f, this last in so far as the after-effect of the diaphragm is greater than that of the spring.

In the second extreme case, the authors neglect the bending stresses and stresses normal to the diaphragm, and confine their analysis to the tensile stresses in the neutral surface. Consider the radial distance r_o at which a tangent plane touches the surface of a diaphragm which is simultaneously deflected down by pressure p and up by tension T. At the point of tangency the tensile stresses have no vertical component, therefore

$$T = \pi \; p \; r_o^2 \tag{4}$$

Thus the distribution of load between the outer ring and the central solid disk depends only on the value of this radius r_o.

For the case of zero deflection, supposing the diaphragm initially flat and free from tensile stresses, when $p = o$ and $T = o$, a solution is quoted from Foeppl,.(op. cit. 5:144, 1907), according to which the deflection ζ as a function of the variable radius r is given by the equation

$$\zeta = \sqrt[3]{\frac{p}{h \; E}} \; \Phi \; (r_1, \; r_2, \; r) \tag{5}$$

and therefore the distribution of load is here also independent of the nature of the diaphragm and consequently the after-effect has no influence on the displacement whenever the latter happens to be zero. But the cases when the displacement is not zero it has not been possible to treat theoretically.

The difficulties of treating corrugated diaphragms are then alluded to, and experiments described in which the diaphragms were loaded with weights T which were varied over a cycle for different constant values of the air pressure p.

The results could be represented by the formula

$$T = ap - Qz + Rz^2$$

where

$$\begin{aligned} Q &= b + cp + dp^2 \\ R &= \beta + \gamma p + \delta p^2 \end{aligned} \tag{6}$$

In most cases R = O so that

$$T = ap - \; (b + cp + dp^2) \; z \tag{6a}$$

As a first approximation it is shown that s_o is again approximately equal to the average of the two radii if one replaces the empirical constant a by the term $\pi \; s_o^2$. Hence, approximately the coefficient a is independent of the nature of the diaphragm so that here again the distribution of the load between the central disk and the rim can not be influenced by after-effect whenever the displacement is zero.

The coefficient b is found to be about forty times as large in the experiment as it would be from the first of the theoretical deductions; moreover, it is found experimentally that b is approximately proportional to the thickness of the diaphragm, whereas, according to the theory given, it should vary with the cube of the thickness. This seeming discrepancy is sufficiently explained by the fact that the observations dealt with large deflections, such as were not contemplated at all in the theory quoted; moreover, the observations were made on corrugated diaphragms.

It is concluded that the coefficients b, c and d, particularly the first, depend on the properties of the diaphragm metal and serve to explain the hysteresis loops.

Upon substituting the value of T from equation (6) into equation (1), and taking the approximate condition R = O, there results the following approximate expression for the sensitivity of an aneroid in terms of the coefficients a, b, c, d and f. The authors consider that this expression warrants special attention because of its simplicity, and because it is reliable to 5% in the cases which they have investigated:

$$\frac{z}{p - p^o} = \frac{a}{f + Q} = \frac{a}{b^t \, f + cp + dp^2} \tag{7b}$$

Dropping the theoretical discussion, the authors announce the conclusion that the means available to diminish the effect of imperfect elasticity in aneroid barometers appear to be three in number, viz.:

I. Select a specially good quality material for the diaphragm. The authors state that they have been able to find nothing superior to hard German silver. But it is important to reduce the thickness of the diaphragm, which they have carried with advantage from the usual .2 mm. down to .05 mm. The diaphragms should be pressed into shape by hand and thereby hardened, for softening was found to make the after-effect excessive.

II. Use a stiff spring so as to have large values of f. If this diminishes the sensitivity of the aneroid too much, one can restore this sensitivity somewhat by increasnig the multiplying power. If this in turn entails too much friction in the mechanism, resort can be made to the vibration device of Mr. Goeppel. This consists of a steel plate attached to the aneroid and caused to vibrate by means of a toothed wheel operated by hand.

III. The foregoing theoretical equations assume vacuum boxes with only a single diaphragm. If both the top and bottom are made flexible, the equations can readily be modified; for example, 7b becomes

$$\frac{z}{p - p_o} = \frac{a}{f + \frac{1}{2} Q} \tag{8}$$

The double surface box reduces the influence of after-effect, therefore, to about one-half what it would be otherwise.

These three principles have been applied to a number of aneroids constructed in the Reichsanstalt shops, the constants of which the authors proceed to give, and the effect of substituting various stiffnesses for the spring and making certain changes of multiplying power are reported numerically. The numerical effect of these substitutions on the observed hysteresis loops is finally given and shown to be quite marked.

In their concluding summary, the authors state that by means of the three methods given, they have succeeded in producing aneroids for which the greatest width of the hysteresis loop between 760 and 410 mm. is not over 2 mm. (It is not very clear how much time the authors allowed for "drift" to take place at the minimum pressure during the tests which established these hysteresis figures; it is merely stated that the rate of change of pressure was about 5 mm. per minute. Their result of slightly over one-half of one per cent is exceptionally good, although by no means surprising if there were direct-return pressure cycles, that is, without prolonged delay at the lowest pressure.)

GÖTTINGEN WIND TUNNEL FOR TESTING AIRCRAFT MODELS*

GENTLEMEN, my intention is simply to give you a brief description of the Göttingen wind tunnel. I shall first say a few words as to how such a plant came to be installed in Göttingen.

The beginning dates back to the "Motorluftschiff Studiengesellschaft" (Society for Airship Study), which was founded in 1906. On the recommendation of the Göttingen Professor of Mathematics and Physics, Felix Klein, and E. Althoff, who was the real founder of the "Motorluftschiff Studiengesellschaft," I was made a member of the Technical Committee, whereupon I called attention to the need of experimenting on models, as had long been done in connection with ship building. The idea found favor and the Motorluftschiff Studiengesellschaft appropriated, at my suggestion, the sum of 20,000 marks, with which the first small plant was begun in Göttingen in the late autumn of 1907. In 1908 it was completed and equipped. The equipment was then gradually tried out and in 1909 we were engaged in practical work. During the war we performed a large share of the experiments reported in the "Technische Berichte der Flugzeugmeisterei" (Technical Bulletin of the Air Service Administration). From the beginning it was of a temporary nature and could not be expected to be permanently satisfactory. It was doubtless better not to build immediately on a large scale, but to wait till the requirements had been carefully worked out. The small plant, however, considering that it was the experimental basis for an ultimate larger and more complete plant, did very satisfactory practical work.

The endeavors to obtain a second building go quite far back. I wrote the first presentation of facts in February, 1911. In 1912 we won the interest of the Emperor William Society for the Promotion of the Sciences. It was again Felix Klein who encouraged me, and it was our former chairman and present honorary member, Mr. Böttinger, who followed up the difficult negotiations with the Emperor William Society so energetically that in 1914 the project was on the point of realization.

Then came the war and our plans were brought to a standstill. We figured indeed on a short war, and no one thought at first of undertaking scientific work with increased energy. But at the beginning of 1915, when we saw that the war was going to last longer, we undertook to attain our goal by a different road, and this time with the support of the military authorities. The Emperor William Society, on the basis of a petition from me, backed by our honorary president, Prince Henry, secured from the war administration an appropriation of 200,000 marks which was afterwards increased to 300,000. Thus the way was opened for us to carry out our plans, and indeed, on a considerably larger scale than the project of 1912.

Naturally there were many obstacles to be overcome even in 1915, and still more during the actual building period. These delayed its completion, after the foundation was begun in the autumn of 1915, till the spring of 1917. Since then the plant has been in constant operation, with a permanent increase in personnel, to meet the needs of the war administration and the aeroplane factories. The scientific work was not neglected, however. Concerning that I had the privilege of addressing you in a theoretical lecture last year in Hamburg.

The plant finally reached a personnel of 50, including engineers, officials and workmen, though it has now been reduced to a third of that number. It is evident that such high pressure (we were then working in two daily shifts) could no longer be justified after the war, as there was no longer any necessity for it. For a long time we were anxious lest the plant would have to be closed altogether for lack of means, since it had not been running long enough during the war to earn any considerable amount of money. It received frequent generous contributions from the war administration for all uncovered expenses. We are hoping that the plant, which has thus been compelled to live from hand to mouth during the last few years, will now be set firmly on its feet. On December 3, 1919, a society was founded, with a membership fee of 1,000 or more marks, which is expected to support the plant for five years. I exhort those in this assembly, who are in a position to do so, to support the plant by joining this society. The expectation is that about half of the running expenses will be paid by the government, while the remaining half will be furnished by the Emperor William Society, by the Göttingen Society for the Promotion of Applied Mathematics and Physics, and by this new supporting society. On this basis, we hope to continue the work during the next few years at least as efficiently as during the past year.

Fig. 1 shows the old 9 x 11 m. plant. In the sectional plan is shown the cylindrical tunnel in which a rotary fan V generates an air current as indicated by the arrows. Various devices serve to keep the air current as free from disturbances as possible. An airship model is shown in the experiment room (M).

In the sectional elevation of the building there is again shown the experiment room with the model, while half of the left side shows the fan and the other half the so-called honeycomb (G_1), a system of parallel cells designed to eliminate diagonal currents.

The old plant was taken down in 1918. The new plant is a substantial building with a hall of reinforced concrete, containing the apparatus, while the front part of the building contains the office, work-room and watchman's room. The restored and improved old building is added to the rear end.

In Fig 2 are shown a plan and a sectional elevation through the laboratory and tunnel. The laboratory is traversed by a 4-ton hand travelling crane. The wind tunnel makes a complete circuit. Its cross-section varies, however, and it is interrupted in the testing room. The open testing room was copied from the Eiffel laboratory. We recognize the Eiffel entrance cone and collector, but in contrast with the Eiffel tunnel (which

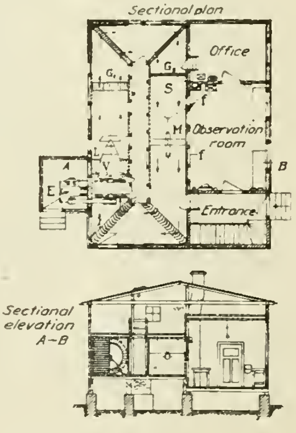

Fig. 1 Old wind tunnel building
G_1 and G_2 = Coarse and fine honey combs
E=Motor L=Directing device f=Window
M=Model S=Sieve V=Fan

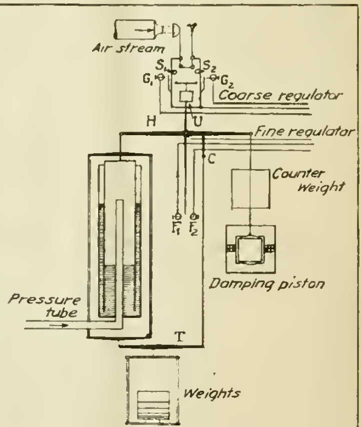

Fig. 3 Diagram of pressure regulator
H = Balance arm
F_1 and F_2 = Fine regulator contacts
G_1 and G_2 = Coarse " "
S_1 and S_2 = Stop pins
U = Astatic weight

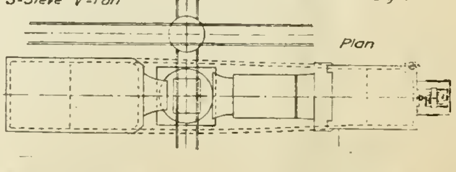

Fig 2 New wind tunnel

Figs 1-2-3

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* From "Berichte und Abhandlungen der Wissenschaftlichen Gesellschaft für Luftfahrt," a supplement to "Zeitschrift für Flugtechnik und Motorluftschiffahrt," September, 1920.

A more detailed description will appear later in the form of a book containing the results of the experimental work of the plant.

begins at the entrance cone and terminates behind the blower, because there must be an airtight room for the experimenter on account of the partial vacuum at the testing point), we have enclosed the return current and are therefore able to make the testing room perfectly accessible. We can enter the testing room with the crane and we can run the testing apparatus (which is provided with wheels) in on tracks. The location of the tracks is shown in the plan. In order to obtain more room for the apparatus, two bays were built, one on either side of the main hall. If, after an aerofoil experiment, a propeller test is to be made, the latter can be prepared in one of the bays and then run in when everything is ready. This is one great advantage of this plant. Another advantage consists in the smoothness anr uniformity of the air current resulting from the series of curved streamlined deflectors in each corner.

Still another advantage lies in the fact that the width of the cross-section behind the blast gradually increases and is then greatly reduced shortly before the measuring place. Thus we have a cross-section of 20 sq. m. back of the entrance cone and of only 4 sq. m. at the testing point. This increases the speed fivefold and the momentum twenty-fivefold, from which it follows that the irregularities ensuing from the inflow only relate to values of 1/25 of the momentum previously obtaining. Thus, without special adjustment, uniformity is assured in the experimental cross-section to within 4% of the momentum, and 2% of the speed. Since the uniformity in the inflowing current is fairly good to start with, it is very satisfactory in the experimental section. In contrast with the former plant, where we could obtain uniformity only through tedious adjustments which, in the course of time often had to be repeated, we here obtained a satisfactorily uniform current at the very outset.

A great saving of power is effected by the arrangement in the new plant. In the old tunnel, with its uniform cross-section, there was a great loss of energy in eliminating the eddies. We have therefore put the straightening device, a honeycomb with cells of only about an inch diameter, in the position of least velocity, thereby causing only a small loss of energy. The energy emerging from the entrance cone, aside from the losses in the open stretch, is utilized in the further circulation, since the whole stream is again collected. In this way the kinetic energy of the air stream in the experimental section is nearly 1½ times the energy of the blast at the driving shaft of the blower. This is made possible by the fact that the kinetic energy is partially recovered in the collector. Hence only about ⅔ of the air energy needs to be furnished at the blower shaft.

In Göttingen we have an alternating current which renders the regulation of the r.p.m. difficult. Consequently, we have installed a motor-generator set (consisting of an induction motor which drives a dynamo) by which the blower motor is driven. The power plant also includes a smaller dynamo for driving the propeller-testing device and an exciting dynamo.

Both dynamos are so-called Ward-Leonard dynamos which can be run at different voltages, so that the blower may be driven at any desired speed from 50 to 1100 r.p.m. In this connection, there is a regulation system, consisting of a coarse and a fine regulator, which influences the field excitation of the dynamos. The fine regulator is operated automatically by a pressure balance or regulator.

Fig. 3 is a diagram of the pressure regulator. It is quite complicated, and I will not try to explain all its details here. The essential points are as follows: The excess pressure in the entrance cone, where the contraction from 20 sq. m. to 4 sq. m. takes place, is communicated by a pipe to the inside of a movable cylinder inverted in a stationary cylinder containing some sealing liquid. The diagram shows how the pressure makes the level of the liquid lower inside than outside the movable cylinder, thereby exerting an upward force corresponding to this difference in level, against the horizontal balance arm H. The equilibrium of the balance is restored by placing weights on the pan at the bottom, these weights being of such values as to give air speeds of 10, 15, etc., up to 50 m. per sec. In the new plant this device is perfectly automatic, while in the old plant a coarse hand adjustment was necessary. In fact, it is only necessary to press a button to set the whole machinery in motion, which automatically adjusts itself to the speed at which the balance arm is horizontal. The whole machinery is stopped by pressing another button.

The maximum power at the blower shaft is about 300 h.p. With such a small electric power plant as that of Göttingen, care must be exercised not to make great load increases too suddenly. The automatic regulator takes care of this.

In Fig. 3 the coarse regulator is shown above the balance arm. It is provided with a special system of springs under compression, so that contacts can only be made when the balance is very unevenly loaded. As soon as an approximate adjustment is made, the coarse regulator is switched off and the work is taken up by the fine regulator, which is shown below the balance arm. It is so arranged that the fine regulator, after reaching its limit, switches the coarse regulator a step further and then another step and does this gradually, so that as soon as the coarse adjustment is made, the fine regulator resumes its work.

In this regulation there was the difficulty that it could not be made, as in the case of a steam engine, for a fixed r.p.m., but must proceed by air speeds from 5 to 50 m. per sec., thus covering a range of 1:10. Such a requirement is made of no engine regulator. Consequently, we were obliged to invent devices (as, for example, the stabilizing of the balance arm by means of the rods C and T) which, I am free to confess, consumed considerable time. This makes the balance arm slower in its movements as more weights are added. When there are no weights on the pan, it is so balanced by the weight U over the pivot, that the balance arm swings almost astatically.

There are many other details not shown on the diagram and which I have not the time to describe, as, for example, a device for preventing over-regulation and an adjustable device for damping the oscillations, etc.

Fig. 4 is an accurate representation of the entrance cone, which can be turned slightly up or down and to the right or left. This is necessary for accurately adjusting the direction of the air current. The forces acting on the balance are resolved into vertical and horizontal. In adjusting this balance, its weight has an influence, for one hangs weights on

(Continued on page 302)

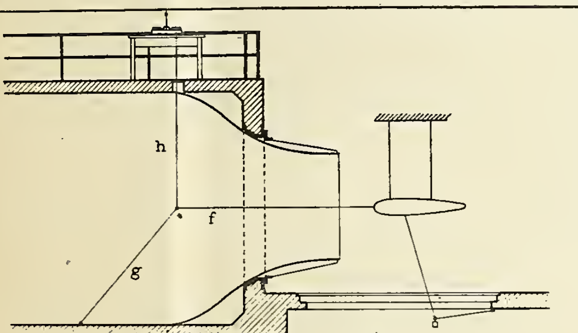

Fig. 4. Entrance cone and method of supporting model for simple drag tests

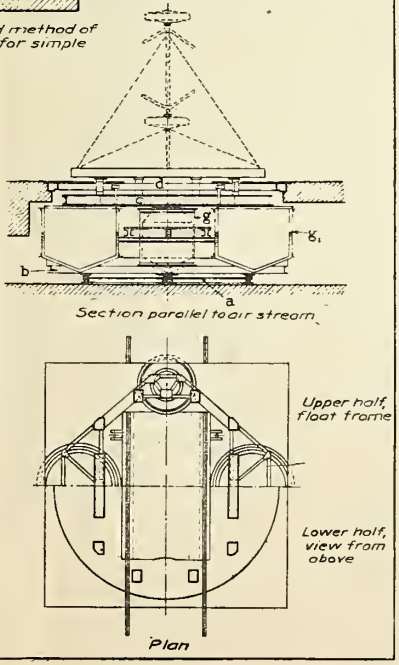
a = Circular tracks for turntable
b and d = Frame for revolving part
c = Float frame
g and g₁ = Water tanks containing floats
d
c
g
g₁
b
a
Section parallel to air stream
Upper half, float frame
Lower half, view from above
Plan

Fig. 5. Turntable with floats.

Figs 4-5

THE MANEUVERS OF GETTING OFF AND LANDING*

By SQUADRON LEADER R. M. HILL, M.C., A.F.C.

PART II.—"GETTING OFF"

3. "Getting Off" as a Forced Maneuver

(*Continued from page 278*)

This paragraph will deal with getting off under unnatural conditions. Suppose the pilot has to fly an aeroplane out of a small field surrounded equally by obstacles, he would naturally wish for a strong wind against which to get off; suppose again that the field is restricted on three sides and the wind is blowing from one of the sides adjacent to the open side, the obstacles on this side being too high for him to surmount, he has the choice of getting off either with a climbing turn, or if there is not enough room for this, towards the open side across wind. It should be noted that more frequently than the actual space of ground available before the wheels lift, it is the obstacles which surround it that worry the pilot, at least in English country.

Take the first case, where the pilot is compelled to surmount the obstacle. Unless it takes the form of steadily rising ground, the pilot would, during the third phase, hold the aeroplane down near the ground gathering as much speed as possible, and then, using up all the energy available to lift him clear, "zoom" as he approached the obstacle and allow himself to sink on the farther side. He could thus surmount a higher obstacle than if the third phase took the form of a steady climb. If, however, the condition at the farther side of the obstacle is to be that of steady climb, R. McKinnon Woods shows, in a theoretical analysis, that nothing is gained by the "zoom." Nevertheless, not only does a "zoom" enable the pilot to surmount a higher obstacle if he allows himself to sink on the farther side, but it means that during the period of the third phase, in which he is holding the aeroplane near to the ground, he will due to his speed have a greater margin of control in preparation for the final effort. If the pilot tries to surmount the obstacle by a steady climb, he is liable to attempt the climb at a very low air-speed, probably lower than his best climbing speed, under the impression that he is climbing faster due to the steep attitude of his aeroplane. In a steady climb at a low air-speed his control will be difficult throughout a sustained period, while in the "zoom" the period during which his control is reduced to a minimum is very short. In the kind of get-off just considered, the pilot naturally makes full use of any head wind there may be.

The second case, where in order to avoid the obstacle the pilot has either to get off with a climbing turn up wind or else straight and across wind, is a different one. The pilot's handling during the climbing turn and when getting off across wind have already been dealt with. If the wind is strong, the climbing turn would probably be preferred; if gentle, the get-off across it. A certain amount can be done to assist the get-off by holding back the aeroplane on the ground by artificial means while the pilot opens the engine full out, and then letting it go; but the pilot must be very sure of his powers of holding down the tail in the slipstream before he can practice this with safety (ref. Part II., para. (1) (*d*)).

If the surface on which the pilot has to get off is wet and sticky, he has to allow very much more time to get clear. As was stated before, he can only try to keep his tail down as much as possible, and never to get off on sticky ground down wind.

The last thing to be considered under getting off is engine failure. This must occur when the pilot is still under the influence of the ground, and from such engine failure more crashes result than from any other one cause. If the engine fails during the first or second phases, the aeroplane can nearly always be brought to rest by the pilot without damage of any consequence. In the third phase his situation is one of peculiar difficulty. When getting off, the pilot should always attempt so to maneuver his aeroplane that should engine failure occur at any moment during the third phase, he will be able to effect a landing on reasonably good ground. With some aerodromes this is difficult; with many fields it is impossible. Nevertheless, it is an aim which should never be lost sight of, and in pursuance of which the climbing turn is particularly helpful. If there is a good piece of ground outside the aerodrome in the upward direction, the pilot should not fly directly towards and over it, for if his engine fails it may be hidden from view beneath his wings; he should maneuver so as to be just on one side of it, so that he always keeps it in view until the completion of the third phase.

If the engine fails near the ground, the trim of the aeroplane may be violently upset, both longitudinally and laterally, and the pilot is bound to lose some height before he regains mental equilibrium and brings the aeroplane to a safe gliding attitude. The chief cause of crashes seems to be the desire of the pilot to turn back down wind in an attempt to land in the aerodrome which he has just left. It is surprising how long it appears to take after climbing steeply with full engine to gain a margin of speed gliding, and how much it appears necessary to depress the nose of the aeroplane. And this must be attributed to the proximity of the ground. The pilot is tempted to commence his turn back before he has gained sufficient gliding speed, and so commences a spin at a low altitude from which there is no recovery. If he has not enough height—300 feet is about a minimum—it is imperative that he should glide on and make some sort of a landing even in very bad ground. It is better to approach bad ground with the power to flatten out than good ground without it. Another feature of the turn down wind is the way in which the apparent rate of travel of the ground up and down wind deceives the pilot. As he turns down wind he thinks he is going faster than he really is, which as it occurs on a turn, puts him, unless he takes the greatest care, in danger of stalling. It is far better to trust to the air-speed indicator reading than to watch the ground under these conditions, and make sure that the margin of speed really exists; for in gliding the stall develops so quickly after the controls first begin to feel sloppy, and the imminent approach of the ground appears so rapid, that the pilot has little chance to correct his error. His best plan, just as in the case of the "zoom," is to dive and gain as much speed as he can before approaching the ground; and rather than commence the turn at a dangerously low speed, carry it out with what speed he can gain during the dive.

The question of engine failure in getting off naturally leads up to a consideration of landing, and engine failure at the beginning of the third phase, when the wheels have just left the ground, will be discussed under that head.

PART III.—LANDING

1. Factors Which Particularly Influence "Landing"

As the factors to be discussed are mainly those which influence the flying qualities near stalling speed, most of them are common to the maneuvers of "Landing" and "Getting Off." As we stated in Part I., para. 2, the period of landing will be divided into two phases; the moment of contact with the ground terminates the first and introduces the second.

The factors which particularly influence landing may be enumerated as follows:

(*a*) The absolute dimensions of the aeroplane.
(*b*) The loading.
(*c*) The stability characteristics and the balance of the aeroplane.
(*d*) The control surfaces and their effectiveness, especially at low speeds.
(*e*) The effect of the slipstream.
(*f*) The height, relative position and character of the undercarriage.
(*g*) The angle of the aeroplane to the ground with the tail down, and the height of the wings above the ground.
(*h*) The pilot's view of and his height from the ground, and his position relative to the C.G. and to the wings.

(*a*) Taking the four sizes of aeroplane considered in Part II., para. 1 (*a*), it may generally be stated that the twin-engined type is more difficult to marshal to the landing position, though simpler to land when correctly in position; that the scout and smaller single-engined two-seaters are easier to maneuver for position, but actually more difficult to land. The very large aeroplane is seldom maneuvered at all, just simply flown in, using one group of engines to prolong the glide. The three phases of getting off require a steady effort of judgment the whole time, while although the approach to land does require nice judgment, the chief effort during landing is more especially concentrated round the few critical moments when the aeroplane is just about to touch the ground. During these moments the timing of the stalled condition must be in complete harmony with the aeroplane's height above the ground, for the slightest error spoils a good landing and involves a disproportionately bad one. Though a bad landing may be saved by the use of engine, it is nevertheless a potential crash.

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* Lecture delivered before the British Aeronautical Society.

The larger types of aeroplane are as a whole easier to land because they are more sluggish and extend the critical period just before contact, so that the pilot has at least the chance of correcting small errors. On the other hand, the smaller aeroplane is more handy during the approach; natural drift can be quickly eliminated, or artificial drift introduced to meet abnormal conditions. If a large aeroplane is drifting near the ground, its sluggishness inhibits the quick removal of the drift. If the smaller aeroplane becomes partially stalled, speed may be regained in time to flatten out. The response of the larger aeroplane under these conditions is so slow that it is actually necessary in order to flatten out to get up a considerably higher speed than would normally be required.

(*b*) Most pilots have noticed the difference in the stall of an aeroplane when it is flown light, and then loaded up heavily. When light, the engine may be switched off and the nose gradually pulled up until the aeroplane sinks gently and puts its nose down again. Load the aeroplane up, however, carry out the same stalling operations, and the aeroplane will answer the elevators until suddenly it drops the nose, usually in conjunction with one wing, and feels as if it wants to spin. Furthermore, the stall occurs at a higher speed. There is a double reason for precluding such slow safe flight; the stall occurs sooner, and the flying qualities associated with it are worse.

As in getting off, the large heavily-loaded aeroplane is worse to handle than the small one. With the small racing scout loaded to an abnormally high figure, the pilot takes his own risk about landing; but as long as landing is purely an effort of judgment, safety on the larger commercial aeroplanes must demand a low landing speed. The tendency is therefore to search for wings whose form may be varied in flight in order to increase the speed range of the heavily-loaded commercial aeroplane by giving an absolutely safe landing speed while retaining a reasonable top speed. Whether the speed range be increased by relatively high power with a fixed wing section and a high landing speed or by variable camber wings and a reduction of the landing speed, there is a definite effect produced on the pilot. If he flies an aeroplane with a big speed range and attempts to land at, say, a third of the speed at which he has been flying, he has, due to the lag of his senses in accommodating themselves to the new conditions, the feeling that he cannot reduce his speed to what appears to him a ridiculously low figure; he feels that he must be stalling, and consequently tends to come in to the aerodrome too fast. With a big speed range it is really difficult to make use of the very lowest speeds that may be safely possible. The pilot is always going faster than he thinks. This effect is particularly noticeable if high speed aeroplanes are watched coming in after a race. They nearly always, allowing for the high loading, tend to come in unreasonably fast because of the pilot's difficulty in adjusting himself. Motorists experience this when a ten-mile limit is approached after motoring fast on the open road.

(*c*) The longitudinally unstable aeroplane is more difficult during the earlier part of the first phase of landing, the stable aeroplane more difficult actually to land. Taking into account what was said about relative size, the large unstable aeroplane is to be avoided at all costs. When in the first phase the pilot is approaching to land the unstable aeroplane, he has to maintain it at the correct speed, and is more likely to be deceived into stalling, especially on a turn; the stable aeroplane, if the tail adjustment admits, and it should admit, can be made to assume a natural gliding speed without trouble, to which it always tends to return.

It will be seen that an unstable aeroplane, although near stalling its instability tends to be reduced, really tends to land itself. The wheels and tail-skid will have probably made contact with the ground before the nose-diving couple is felt. If the unstable trimming speed is arranged to coincide with or slightly exceed the desired speed of glide, the pilot has only to release the control stick at the right moment and the aeroplane will naturally stall itself gently on to the ground; in any case, with very little effort the pilot can gently check or assist the motion to bring about a favorable conclusion.

If the aeroplane is stable and is set to trim at the desired speed of glide, the stalling moment of the elevators will be progressively opposed by the effect of longitudinal stability, until just before contact with the ground the nose-diving couple requires the full upward movement of the elevator to counteract it. The movement of the control stick to flatten out begins gently and ends in a comparatively violent pull right back that must be perfectly timed; if it is made a moment too soon, the control is all used up and the nose-diving couple bangs the wheels on the ground. The onset of the nose-diving couple may be in some measure postponed by arranging the trimming speed to be slower than the desired speed of glide, that is, making the aeroplane feel slightly tail-heavy gliding; but this always introduces the tendency to stall during the earlier part of the first phase.

Unlike longitudinal instability, lateral instability does nothing but increase the pilot's difficulties. Dihedral certainly postpones the dropping of one wing, and aeroplanes with no dihedral drop one wing very quickly and land hard on one wheel if not stalled directly on to the ground. But practically all aeroplanes show this tendency to some degree, which is just what the aeroplane, as a structure, will not stand. The drop that an aeroplane will stand up to on one wheel is insignificant compared to the drop on both wheels equally; and it is nearly always heavily-loaded aeroplanes that upset the pilot by suddenly dropping a wing.

(*d*) Professor B. M. Jones has said that a truer criterion of the landing difficulty than the stalling speed is the slowest safe speed of maneuver near the ground, and sugegsts that although in general the margin of speed necessary with different types is at present of the same order, this margin could be materially reduced if the control near stalling could be improved. I think that it is on the confidence that the flying qualities near stalling give to the pilot that he bases his judgment of the lowest safe speed. In most aeroplanes the lateral trouble develops first; and if the aeroplane, though highly controllable longitudinally at low speeds, is vicious laterally, the extra longitudinal control will avail the pilot practically nothing. It is essential that if the flying qualities near stalling are to be improved the lateral and longitudinal be kept on a par; and in present-day aeroplanes the lateral element needs improving to bring it up to the longitudinal.

A feature that tends to mar the longitudinal control is a large difference of trim with engine on and off. Not only should the range of the adjustable tail be amply sufficient to cope with this, but the difference should be reduced as much as possible to make the necessity of a large tail range remote. The pilot does not want to be hampered in making full use of his primary organ of longitudinal control, the elevator, by compulsory attention to his secondary organ, the adjustable tail plane. Especially does this hold should he be compelled to make use of his engine suddenly to save a bad landing. He has no time or energy to concentrate on anything but the simplest control mechanism when he is in close approach to the ground.

During the war a form of air brake was fitted to a service aeroplane with the idea of increasing the gliding angle and pulling the aeroplane up on the ground. H. Glauert has pointed out in R. & M. 667 that the speed drops so rapidly in the run along the ground as to render such brakes of little use. The increase of gliding angle certainly does assist the pilot to get into a confined space over obstacles, but a distinct danger arises from the fact that the pilot is likely to bring his air brakes into action while coming in without realizing what his change of gliding angle means. To glide in at the same speed he must keep his angle of incidence the same, and so must rotate the body of the aeroplane through the change in gliding angle. Because he suddenly glides steeper the idea is presented that he is going correspondingly faster, and on this assumption he may commence maneuvers which he would not otherwise attempt. It is always a question whether it is wise for the pilot to change the characteristics of his aeroplane when under the influence of the ground.

In getting off, with the point at which he leaves the ground as his starting point, the pilot has, within fairly wide limits, freedom as to his subsequent direction; his lateral control is mainly necessary for counteracting casual disturbances and only in a wide sense for voluntary maneuver. In landing, on the other hand, his maneuvers are executed with the express purpose of arriving at a definite point; and, if he is unwilling to face judging a long straight glide or relying on his engine, they may be termed compulsory, almost involuntary, maneuvers. His lateral control is then more important still, for it has to be utilized to counteract disturbances simultaneously with the execution of low-speed maneuvers. Although the aileron control has not been found in practice to reverse, the yawing moment due to the ailerons is more noticeable even than in getting off, probably owing to the small slipstream effect on the rudder. Some pilots actually appear to utilize the yawing moment to assist maneuvers for losing height at the edge of the aerodrome, but unless the pilot is experienced, considerable risk is involved.

The rudder control suffers badly at low speeds, for if the rudder is made small enough to be reasonably light at high speeds, it is usually overpowered by the ailerons near stalling. This may be, and is, partly overcome by the use of balanced rudders, but the balancing itself, if carried out to any extent introduces other difficulties.

Some aeroplanes, especially those without steerable tail-skids, show a tendency to spin round on the ground during the second phase, and the rudder is not sufficiently effective to prevent this spin. The pilot might give the rudder more power by a burst of engine and the subsequent slipstream effect; but he is often unwilling to increase the speed at which he is running along when on a turn. In any case it is unwise to check the turn too violently; the aeroplane should be allowed to go on turning until nearly all speed is lost before risking a burst of engine.

(*e*) It is not always sufficiently realized how different an aeroplane feels when the engine is throttled down for gliding and when it is completely switched off. The pilot relies more than he knows on this slipstream effect, small as it is, to assist his rudder. If his engine fails completely, and he has not tried flying the particular type of aeroplane with no engine at all, he frequently experiences a feeling of helpfulness for a few moments until he has accommodated himself to the new conditions. The rudder control of many aeroplanes at low speeds without any slipstream is by no means satisfactory, neither are these difficulties imaginary.

When carrying out maneuvers for losing height at the edge of the aerodrome the pilot finds an occasional burst of engine of the greatest use to assist his control. These bursts of engine are not always given, as is often supposed, to prolong the glide. As has been stated before, the secret of maneuvering at low speeds is the co-ordination of the rudder and ailerons; lack of co-ordination means a loss of height, and more important, of direction, before the error can be corrected. The pilot is thus hindered in his attempt to arrive at the desired landing point. When the rudder and ailerons are not co-ordinated properly, the aeroplane, if on a turn, seems to stick, or its motion becomes jerky. A burst of engine, espesially in a large aeroplane, will often relieve this condition at once by assisting the rudder.

(*f*) If the undercarriage is high, the pilot feels that his aeroplane as a structure is top heavy during the second phase of landing. If for a moment the value of a large angle of the wings to the ground is set aside, the pilot always feels safer if the vertical distance from the wheel axis to the C.G. and to the line of thrust is kept to a minimum, because the overturning tendency is thereby reduced. He further realizes that if he does go over, the impact will be much less severe.

The necessity of ground feel, advocated for getting off, is of no importance in landing, probably because the conditions of the second phase of getting off are generally avoided. In landing, the aeroplane is either definitely air borne or running along with its tail-skid on the ground. In getting off it was noticed that an Oleo type of undercarriage tended to eliminate the ground feel which was of value to the pilot, whereas in landing this is of no moment, and excellent shock-absorbing properties are essential to preserve the structure from damage.

One of the worst features of the present-day undercarriage is its incapacity to stand up to lateral loads. The pilot has always to concentrate on eliminating drift prior to contact with the ground. This, due to the bad rudder control at low speeds, is often difficult to achieve. Consequently a large proportion of minor crashes are due to landing with drift and the subsequent collapse of the undercarriage.

In the simple "V" type of undercarriage, the wheel position, which even now is quite a delicate matter to determine, is of the greatest importance. It usually has to be settled by practical trial. If the wheels are too far back, the overturning moment may be more than the controlling moment of the elevators with the reduced slipstream, especially if the aeroplane bounces in landing. If the wheels are too far forward, the aeroplane is inclined to "bucket" and an oscillation is set up, which if not taken in hand by the pilot and damped at an early stage, may also result in the aeroplane turning over. If the aeroplane starts to "bucket" the tail-skid receives severe shocks. The only advantage of wheels placed far forward is that landing on soft ground is made easier. The advantage to the pilot of such a wheel position can be reproduced on commercial aeroplanes where the maximum reduction of weight and resistance is not so essential as in war aeroplanes, by wheels placed in tandem. If ground brakes are employed, and it seems likely they will be necessary in future, tandem wheels are essential. H. Glauert points out in R. & M. 667 that if ground brakes are employed a reduction of the run is only effected by increasing the angle of the wings to the ground above the critical angle. If the increase of angle is within limits below the critical angle, the run is not sensibly shortened.

Especially on large aeroplanes a wide wheel track is of great advantage in steadying them if they are not landed with the wings level. One small scout at least has been successfully fitted with a wide track undercarriage. Although this aeroplane is inclined to oscillate sideways due to uneven ground, it lands well and safely, and has less tendency to spin round on the ground after landing. On single-engined aeroplanes built for war purposes, the undercarriage has usually been fitted to the fuselage unit, which has more or less settled the width of the track. For commercial aeroplanes a wide track should make them on the whole easier and safer to land.

The pilot can make a safer landing on soft ground by having his tires fairly soft so as to widen the effective tread.

To sum up, it is suggested that the vertical distance from the wheel axis to the C.G. and thrust line should be kept to a minimum; that undercarriages should be made capable of absorbing side shocks to a much greater extent; that the desirability of good shock-absorbing properties is in no way lessened by a necessity for ground feel in landing; and that on commercial aeroplanes tandem wheels combined with the widest wheel track possible will make for safety and ease of landing.

(*To be concluded*)

(*Continued from page* 299)

the balance and observes the deflection of the horizontal and vertical arms. When the air current is not horizontal there is an inaccurate resolution of the components and, since the drag is relatively small and the lift large, an error in the drag, through a lift component, is very important. We accordingly make control measurements: One with the convex side of the aerofoil up, and the other with it down. If both measurements are not the same, the cone is not properly adjusted.

Fig. 4 shows an arrangement which we have employed (especially at first, before our experimental arrangements were entirely completed) in measuring simple resistances. The model hangs on vertical wires. The wire underneath, with the weight, serves to hold the measuring wire taut. The latter branches, in the cone, into two wires, whereby the resistance to be measured is resolved into two forces in these directions. One wire goes to a balance above the cone where the force can be measured. We have employed this device especially for hanging full-sized objects in the air current and measuring their resistance. Various published data were obtained in this manner.

The entrance cone is made of wood, lined with sheet-iron and supported externally by a light iron framework, with which the diagonal adjusting rods are connected. The larger end of the cone is supported by a cast-iron rim in the wall. Excepting the part between the entrance cone and the blower, which is made of wood and iron, the tunnel is made of reinforced concrete, which has proved very satisfactory. Even the deflectors are made of reinforced concrete and simply brought into position with a crane and walled in.

A measuring device serves for measuring the speed distribution in the air current, for testing its uniformity, on the one hand, and for determining the speed in the vicinity of the object on the other hand. This device is comparatively new and only a few tests have yet been made with it. Otherwise I would have shown you a diagram of the uniformity of the air current. The reason I do not do so is chiefly because our recording manometer must be reconstructed in order to do really accurate work. I expect, however, to be able to do so at our next meeting. On a car which can run horizontally on the wooden rails there is a tower on which a second car runs in a vertical direction. Through the latter runs a rod on the end of which is a pressure gage. Thus all points can be reached. By means of a pressure recording device a line is drawn for either the horizontal or vertical direction.

Fig. 5 shows a device that is located under the floor of the experiment room. (In Fig. 4 this space is left empty, corresponding to its condition at the beginning of 1917.) This is a very noteworthy object, consisting of a turntable with floats and a trap. When the experimental apparatus is wheeled in it cannot be left on wheels, but must rest on stationary supports, since only thus can accurate weighings be made. Hence it is necessary to have some special provision for supporting the heavy apaparatus which weighs from 500 to 1,500 kg. We have hit upon the expedient of lowering the central portion of the track on four spindles. These may be either outside the turntable or even on the turntable, if necessary, whereby the entire measuring apparatus can be swung through a moderate angle (so that, for example, a propeller can be tested in an oblique position with reference to the air current).

(*To be concluded*)

NAVAL and MILITARY AERONAUTICS

General Menoher Heads First Division

Maj.-Gen. Charles T. Menoher, formerly Chief of Air Service, has been assigned to command the First Division at Camp Dix, N. J., relieving Maj.-Gen. D. C. Shanks, who, under orders issued by the War Department, October 25, assumes command of the Fourth Army Corps Area, with headquarters at Atlanta, Ga.

Resumption of Recruiting for Air Service

The Air Service is in immediate need of over 3,000 enlisted men to fill existing vacancies, and authority for the procurement of these recruits was contained in a letter from the Adjutant General of the Army, dated September 8, 1921, which outlined the procedure to be followed in securing recruits. Additional instructions regarding recruiting were subsequently issued by the Adjutant General in a series of recruiting letters.

Recruiting will again be conducted under the direction of Corps Area Commanders. Under this plan the Air Officer is the representative of the Chief of Air Service for all matters pertaining to recruiting for the Air Service within the corps area, and therefore the successful solution of the present recruiting problem is directly in the hands of the Air Officer. Each Corps Area Air Officer and the Commanding Officer of Bolling Field, Anacostia, D. C., has been directed to submit on December 31, 1921, a detailed report concerning recruiting activities for the Air Service within the corps area or district. Certain quotas have been assigned to various corps areas, but as these do not take into consideration current losses through discharge, it will be necessary from time to time to increase those quotas to compensate for such losses.

The distribution of the authorized strength of the Air Service by organizations is as follows:

Organization	*Strength of Organization*	*Number of Organizations*	*Total Strength*
Wing Headquarters	20	1	20
Group Headquarters (H/A)	35	6	210
Group Headquarters (L/A)	18	1	18
Squadrons	132	25	3300
Squadrons (R. S.)	90	10	900
Balloon Companies	130	3	390
Balloon Companies (Coast Defense)	100	8	800
Airship Companies	130	6	780
Air Parks	172	10	1720
Branch Intelligence Offices	5	6	30
Air Offices Casual Detachments	4	6	24
Photo Sections	20	13	260
Field Officers School	96	1	96
Photo School	51	1	51
Airship School	150	1	150
Pilot School	500	1	500
Gunnery Detachment	75	1	75
Mechanics School	100	1	100
Observation School	400	1	400
Balloon School	150	1	150
Flying Cadets	—	—	276
Communications School	50	1	50
			10,300

The following vacancies for enlisted men now exist at Air Service stations:

	Heavier-than-Air	*Lighter-than-Air*
Mitchel Field, N. Y.	479	
Aberdeen, Md.	3	33
Lee Hall, Va.		84
Langley Field, Va.	168	206
Montgomery, Ala. Air Intermediate Depot	33	
Carlstrom Field, Arcadia, Fla	305	
Camp Knox, Ky	55	
Scott Field, Belleville, Ill.		87
Chanute Field, Rantoul, Ill.	976	
Fort Riley, Kansas	110	
Brooks Field, San Antonio, Texas		166
Ellington Field, Houston, Texas	296	
Kelly Field, San Antonio, Texas	433	
Post Field, Fort Sill, Okla	4	91
Rockwell Field, San Diego, Calif	9	
*March Field, Riverside, Calif	113	
Bolling Field, Anacostia, D. C.	95	

*For duty in Hawaii.

Post School at Kelly Field

In compliance with recent War Department instructions, a post school will be started at Kelly Field, San Antonio, Texas, on November 1, 1921. The following subjects will be taught:

Educational: Common School Branches.

Vocational: Automotive, Ignition, Carburetion, Transmission, Trouble shooting.

Business: Typewriting and clerical work (Army).

Communications: Radio, Installation, Operation.

Telephony: Installation and switchboard work.

Utilities: Carpentry and brick masonry. This school is open to all enlisted men.

Chamber Gives Dinner In Honor of Capt. Mustin

The San Diego Chamber of Commerce gave Capt. Henry V. Mustin a farewell dinner at the San Diego hotel. Speakers of the evening included Admirals Welles and Burrage, William Kettner and E. B. Gould. Mr. Gould, president of the chamber of commerce, was toastmaster. The evening was enjoyed by everyone present.

Toastmaster Gould, after calling attention to the fact that Capt. Mustin is a citizen of Coronado, presented, on behalf of the chamber of commerce, a gold pencil to the retiring air squadron commander.

Flying in the Philippines

Commenting on the varied character of the country encountered by the aeroplane pilot on duty in the Philippines, the Commanding Officer of Clark Field, Camp Stotsenburg, Pampanga, P. I., states that flying throughout the islands is hazardous away from the airdromes. "The abundance of rice paddies, the uneven and heavily overgrown contour, now gently rolling, then abruptly mountainous, combine in presenting but few routes on which emergency fields are to be found. While in most rice sections in the States no very great hazard is encountered through emergency landings in the paddies, the local paddies are deeply terraced to overcome the unevenness of terrain. So far there is no record of a forced landing here in a cane field, but it is believed the heavy stalks would not prove an easier place to set the plane down than a paddy. While on the subject of the islands it is surprising to note the seemingly numerous localities which are little, if at all, known to white men. The peak of Mt. Pinatuba, approximately 12 miles airline from Clark Field, is said to be inaccessible, the sides of the mountain being sheer or extremely precipitate and the approaches heavily obstructed by tropical vegetation. It is also said that a tribe of Moro headhunters infest the region, which does not add to our enthusiasm for exploring too far afield in that direction."

Forest Patrol Operations from March Field

Forest fire patrols from March Field started on August 21, 1921. Two patrols were flown. The circle patrol, leaving the field daily, covers 185 miles and takes in San Gabriel Canyon on the northwest, Baldwin Lake on the east, and San Jacinto Mountain on the southeast. The Santa Barbara Patrol, leaving the field one day and returning the next, covers 215 miles one way. Fifty fires have been reported since the patrol started. The Air Service report was the first received on twelve of this number. On nine of the fifty the location was 100% efficient, twenty were 80% efficient, and two were missed entirely. The accuracy of the remainder cannot be determined, as they were unconfirmed at the time bi-monthly reports were submitted. Ninety-five per cent of the fires were reported within ten minutes of the time of discovery. The radio efficiency for the season was 95%, i. e., the ships were in communication with the ground 95% of their time in the air. The circle patrol was discontinued on October 27th, while the Santa Barbara patrol will be flown until November 15th.

New Airship Napoli Is to Eclipse Roma

Rome.—The giant airship Roma, which Italy sold to the United States Government, is looked upon as such a great success that the Italian air authorities are building another on much the same lines, only bigger and better, profiting by experience. It will be called the Napoli or Naples, and probably will be the second of a large fleet of air monsters.

The Roma measures 34,000 square metres; the Napoli will be 54,000. Like the Roma, the Napoli will be of the semi-rigid type. Her shape will be much the same as the sister airship though more elongated.

As in the case of the Roma, the car will be in the steel beams of the ship. It will hold a commandant's cabin with all necessary instruments, a passengers' cabin, a dining room, lounges and a kitchen run with electricity.

At the rear of the ship will be terraces for the passengers to admire the scenery at their ease.

There will be twelve Spa motors of 300 horsepower each, Italian designed and constructed. They are to be set tandem in the steel ribs in such a way that they can be repaired and even changed, if needful, during flight.

The Napoli will be able to carry a hundred passengers. With only four of its engines working its speed is expected to be forty-three miles an hour.

FOREIGN NEWS

Australia Refuses to Cut Aircraft Fund

Opposing a labor motion introduced in Parliament for the reduction of the air force appropriation, Premier Hughes declared November 22 that Australians "cannot yet rely overmuch on the Washington conference."

"The United States and Japan had launched new warships," he added, "while Great Britain, to show good faith, stopped building, throwing thousands out of work. Therefore it would be unwise to scrap our air force." The motion was rejected.

Plane Outspeeds Tempest in Night

A thrilling air race with a thunderstorm, with approaching darkness and a dwindling petrol supply, was the experience of Robert Barton, assistant general manager of the American Express Company in Paris, and Mrs. Barton, while flying in Spain. They arrived in Madrid safely in almost total darkness as their aeroplane engine gave its last gasps because of an empty petrol tank, but the storm broke on them so suddenly they were soaked through to the skin before they could reach the shelter of a hangar. They were in a De Haviland aeroplane piloted by Alan J. Cobham, who, it will he remembered, late last year made the long distance commercial airflight record by flying over all the European countries in six weeks, travelling 4,500 miles in all.

Cobham, who was delivering the aeroplane to a Spanish firm which is in commercial aviation between Seville and El Araish, on the Moroccan coast, took Mr. and Mrs. Barton as passengers. She had never flown before. After four flying hours they passed the night in Bordeaux. The next day they passed down the French coast and flew to San Sebastian and then over the Pyrenees to Victoria. Beyond Aranda, over the Guadarrama Mountains, his petrol supply was exhausted and Cobham landed in a small ploughed field. He managed, however, to buy a little gasoline from a passing automobile. Then he took off safely for a thirty-five minute dash to Madrid, when he saw a storm headed toward him. He flew over a country where landing would have been dangerous when it was nearly dark and finally won out. The Bartons were thrilled and greatly pleased over what was to them an adventure.

Cobham had delivered three De Haviland aeroplanes from London to Madrid without accident and inaugurated the first Spanish air service, which is now called the only punctual means of flying in Spain. These aeroplanes are operated with English pilots and mechanics, making in two hours a trip which previously required between seven and fourteen days.

Second International Aero-Exhibition at Prague

The Czechoslovak Aero Club organized in the days from 22nd to 30th of October, 1921, under the patronage of the President of the Czechoslovak Republic, Dr. Thomas Garrigue Masaryk, and under the assistance of the Government its second international aero exhibition at Prague. The success of the exhibition was secured owing to the participation of numerous inland and foreign exhibitors, further owing to an efficient propaganda and last but not least to the careful arrangement of the exhibition. Notwithstanding the mobilization, the exhibition remained open.

A considerable part of the obtained good results have without any doubt the air of politics of Czechoslovakia. Such intensive and foreseeing activity in matters of aviation could not be found in any other new State of central Europe, the policy of this Republic being the maintenance of the primacy in aviation among all these States.

The exhibition was again held at the Palace of Industry in the Exhibition Ground at Prague, area 10,000 square meters, and besides a great participation of the public, several official delegations from foreign States visited the exhibition and have shown a remarkable interest in the exhibited machines and engines.

The exhibition has been inaugurated by the Minister of Public Works, Tucny, who accentuated that the Government appreciates fully the work of the Czechoslovak Aero Club and will spare no means and efforts for the development of aviation in the country. The exhibition has been visited by President Masaryk, who expressed his satisfaction on the progress of the home aircraft industry, and by several Ministers, among whom the Minister of National Defence Udrzal, the Generals Syrovy, Cecek and others.

From the exhibiting firms, we may mention:

The "Compagnie Franco-Roumanie de Navigation Aérienne," which is running the air transport service between Paris-Strassbourg-Prague Warsaw, exhibited a limousine commercial aeroplane Blériot-Spad with 260 h.p. Salmson engine.

The "Societá Anonima Fiat at Turin" exhibited a 300 h.p. radial 9-cylinder engine and a 400 h.p. 8-cylinder engine in V-form.

The "Aero" aircraft works Prague exhibited a chaser "Ae.0.2" (design Vlasák-Husnik) with 220 h.p. motor Hispano-Suiza, a chaser "Ae.0.3" (design Engineer Rösner) with Hispano-Suiza engine, and a chaser "Ae.0.4" (design Vlasák-Husník) with 185 B.M.W. motor.

The "Avia" Works Prague-Vysocan exhibited: a sporting monoplane, two-seater "Avia B.H.1" (design Benes-Hajn) fitted with a 48 h.p. Gnome, a sporting monoplane "Avia B.H.2" (design Benes-Hajn), 20 h.p. motor; a chaser monoplane "Avia B.H.3" (Benes-Hajn), fitted with a 185 h.p. B.M.W. motor.

The Military Aircraft Works Prague-Gbely exhibited a fighter two-seater biplane Sm.2 (design Smolik), 260 h.p. Maybach engine.

The "Ardea" factory exhibited a school monoplane "B.P.1" fitted with 70 h.p. Mercedes motor.

Air Lines in Winter

In an interesting article in the *London Observer,* Major C. C. Turner discusses Airlines in Winter as follows:

The new system of subsidies to approved British companies using approved aeroplanes on the London-Continental services, which was to have come into operation this month, is delayed until February. Four firms have been approved, three for the Paris and one for the Brussels line. The terms of the new subsidies as published last June have been modified in favor of the firms; and they are even now regarded as ungenerous by some. On the other hand, at least one of the companies has expressed satisfaction.

Interesting points are raised in discussion of these matters. A common impression that the whole of a sum allocated for subsidies is necessarily expended is erroneous. The subsidies are partly proportionate to revenue; and, as a matter of fact, some of the £50,000 set aside last March has not been spent. The system on which it was laid out will be continued through the winter.

It should be remembered that the amount of traffic is limited, and that the subsidies only apply to firms running from England to the Continent. As a consequence, the grant is not likely to be used up; and when the traffic is split up between four firms, as it will be, it is perfectly clear there is not much in it for any one of them. That is one of the complaints; it is urged that the Air Ministry should have approved of no more than two firms, or that in order to avoid any suspicion of giving a monopoly it should have called together a national corporation representing the whole industry to run the services.

Again, it is clear that taking the services on successes achieved during a very fine summer is unfair; they must be judged on an all-the-year-round basis. During the summer there have been times when there were too many passengers for the machines. Now the number of passengers is falling off, and the companies are realizing that freight of a less fluctuating character would be desirable.

Unfortunately, from the first passengers were regarded as the main business, and mails and parcels as secondary. The present writer has all along contended that mails should be put first; and passengers as a variable quantity.

Air mails have not been encouraged as they ought to have been, yet they could make up a steady volume of paying freight all the year round without noticeably encroaching upon existing railway interests. And mails are more remunerative than passengers. A passenger weighing with his luggage 180 lbs. is charged six guineas for a flight to Paris. Parcels are charged at 1s. per lb., so that 180 lbs. of parcels yield £9. It would take 2,880 one-ounce letters to make up the same weight; and if out of the 3d. fee one penny was set aside for the cost of air transport from Waddon to Le Bourget the yield would be £12, leaving a further £24 for the cost of collection, delivery, and road transport. Of course, there would not be enough mail to fill up several big machines every day. But if the Post Office would co-operate to the extent of handing over a definite quantity most of the present difficulties would be met.

Limiting the air-lines to the south-east corner of England has, as the writer foretold, had a crippling effect. The organization has had to be built up, but there has been no encouragement of quantity production of machines. Had the Post Office been asked by the Air Ministry two years ago to co-operate for the encouragement of inland air lines the actual cost of air transport would today be much less than it is. Besides which, there would have been in existence a big reserve for the Royal Air Force.

The Post Office would have had a right to demand reasonable regularity. This would be possible to achieve with existing knowledge and appliances; but it should be remembered that on the rare occasions when aeroplanes could not fly the mails would be diverted to the railway. After all, it would only be a small proportion of the total mails.

The Air Ministry repeat the opinion that for the present attention should be confined to the Continental lines. It may be doubted whether, all the while this view is taken, any progress will be possible.

Ex-King Karl and the Ad Astra Co.

As a sequel to Karl's recent escapade he has, according to a report to hand, had a couple of his motor-cars and about £1,500 standing to his credit in Swiss banks "sequestrated" on account of the Ad Astra Aero Co., of Zurich, who were the owners of the aeroplane which the ex-King "commandeered" to carry him to Hungary. A very pretty tit-for-tat.

Airships and the United States

Mr. Gilbert on November 2 asked the Secretary of State for Air in the British Parliament, whether it is proposed to offer the American Government another airship for the one that was unfortunately lost; if so, can he state what ship has been offered to them, when it is proposed to deliver the same, and at what air station; if such ship has been accepted by the United States authorities; and can he make any general statement on the subject?

Mr. Parker: The answer to the first part of the question is in the negative, and the remaining parts do not, therefore, arise.

The Fleet and Air Observers

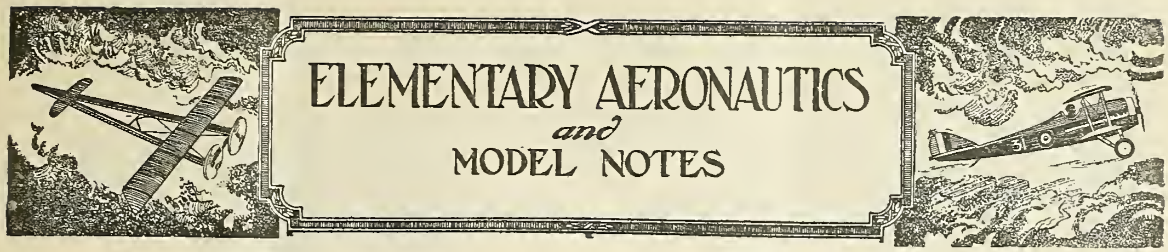
Upon similar lines to the specialist branches for gunnery, torpedo, navigation and signals, the British Admiralty have decided to make a specialist branch of the Air Observers among naval officers. For the present, eight officers will be selected each half-year. In time, only junior lieutenants of two years and upwards will be selected, as in other specialist branches, but a few commanders and lieutenant-commanders are required, immediately for training. Courses, each of seven months' duration, will begin in May and November in each year, and will include two months' preliminary training at the naval schools in gunnery and signals, and five months at the seaplane training school at Lee-on-Solent.

While under training with the R.A.F. officers will receive the full pay of their naval rank, with extra remuneration for each actual day of ascent, of 3*s.* in the case of commissioned and subordinate officers, and 1*s.* 6*d.* in the case of warrant officers. After qualifying they will be eligible for appointment as observers in aircraft carriers in the Royal Navy, and while actually detailed as trained observers will receive allowances of 4*s.* and 2*s.* a day respectively. If qualified in wireless telegraphy, these allowances will be increased to 6*s.* and 3*s.* a day. Officers will retain their naval rank and wear naval uniform while under training. On completing the qualifying course they will be rated probationary observers and appointed to fleet carriers for further training. On completing six months, including a course at Leucbars, Fife, they will be eligible for confirmation on the recommendation of the Commander-in-Chief of the Atlantic Fleet.

Avro-Sunbeams in Australia

Particulars are to hand of some performances of Avro commercial biplanes fitted with Sunbeam-Coatalen "Dyak" 100 h.p. engines, which are being produced in considerable quantities in Australia. Up to the time of writing, one machine has carried no less than 283 passengers in 111 flying hours, covering in that time a distance of over 7,400 miles, without mishap.

A similar biplane, the property of Mr. P. Hogarth, Clio, Queensland, made a trip of 1,845 miles in 20 hours' flying time, the average speed being 92.5 m.p.h. The engine gave no trouble throughout the whole of the trip, and the pilot never had a moment's anxiety. This flight was over very sparsely inhabited country, which would, in many parts, be practically impassable by motor-cars, and the value of such expeditious means of transport in such a country can scarcely be over-estimated. The owner of the machine in question, Mr. Hogarth, expresses himself that the aeroplane is the one and only practical means of transport for his district.



ELEMENTARY AERONAUTICS and MODEL NOTES

Some Notes Regarding Soaring Birds

SEVERAL years ago, in the course of his work in India, Captain H. S. Wildeblood (M. Inst. C. E., A. F. R. Ae. S.) made some interesting notes concerning soaring birds. Since very little of information of the character has been published before, his observations may prove of value to those studying the problem of man-carrying soaring machines and gliders.

To sum up his observations, the following points are worthy of consideration:

(1) Soaring birds seem to soar only when there is a perceptible breeze, and to prefer to soar in a strong wind.

(2) The theories of upward currents, pulsating winds and sun soarability, though not disproved by these observations, receive no support therefrom.

(3) Whether all, or any, soaring birds recede their wing-tips in order to obtain lateral stability is at present doubtful, though there is evidence that some of them do so when there is a strong wind blowing.

(4) Soaring birds appear to move the wing tips only, on the side which they wish to depress. This appears to prove that they rely on the use of the negative angle, on one wing tip only, for altering or introducing lateral cant, and that they do not move the other wing or wing tip for this purpose.

(5) The action in turning to right or left is not easy to follow, but is conceivably due to the use of the negative angle in a wing tip, which induces turning and canting simultaneously.

(6) Birds swoop down by receding their wing tips.

(7) It is obvious that a soaring bird, like the cheel, can, in a wind, reach any point he desires and at any height, without a single flap of the wings; he can travel for miles dead on to a gale, with no perceptible loss of height and he can, by circling, rapidly gain increase of height.

(8) These apparent phenomena are not adequately explained by any accepted theory of the present day.

(9) The matter is of great importance and will probably influence the future of flight to a much greater extent than any of us now recognize. It may indeed open up a way for the yacht of the air, if it can be solved, and the possibilities in this direction are boundless.

(10) As a basis for discussion the following tentative theories are proposed:

a—That within certain angles of incidence and at certain relative air speeds, the resultant wind force acting on a soaring bird is inclined forward at an angle with the vertical; and that this enables the bird to travel forward against a strong head wind with no loss of height.

b—That in order to gain rapid increase in height the manoeuvre of circling is adopted and that this consists, broadly speaking, of a sharp run down wind at a small angle of incidence with very little loss of height and of a rush up wind at an increased angle of incidence with great increase of height. In order to prevent loss of position relative to the earth, the bird manoeuvres in accordance with theory (a) during part of the time that he is facing the wind.

In order to gain height rapidly it is necessary for soaring birds to circle. The gain of height on the up wind side of the circle is far greater than the loss of height, if any, on the downward side, the former being very evident and the latter imperceptible.

While the bird is circling, his inner wing tip is lower than his outer, except when he is facing the wind. He is then horizontal or nearly so. His greatest cant, or lateral angle of inclination, in circling is usually about forty-five degrees or so.

A rather clumsy looking vulture which was observed to be gaining height in circling was seen to lose ground rapidly, that is, he was drifting to leeward with each circle, and that each time he faced the wind, though he gained height, he was pulled up rapidly and had to turn. A cheel in the vicinity was getting along much more smoothly. There is some virtue in the act of circling which lifts the bird up rapidly whereas a bird heading against the wind for a long time cannot gain height to any appreciable extent, if at all. In circling, the bird certainly gains velocity when gliding down wind. As soon as he faces the wind he is visibly carried upwards by it, though his drop in gliding down wind has not been noticeable.

The cheels can float about with, across, and against the wind with very little, if any, loss of height and with a very small, if any, angle of incidence of the wings. They are able to lie on the wind, facing it, without advancing, sometimes receding a little, and without either rising or falling perceptibly. They can advance indefinitely against the wind with no apparent loss of height, but in doing so they cannot gain height rapidly, as they do in circling.

From these observations it appears that the resultant wind force acting on them is nearly vertical and may even be inclined forward slightly, so that backward drag is eliminated, and there may even be a slight forward component in its place when a cheel is floating on a wind of considerable velocity and facing it at a very slight, or zero, or even negative angle of incidence, the latter being understood to be the inclination to the wind of a line drawn from leading to trailing edge of the cambered part of the wing.

If the resultant wind force is inclined forward and if it is of such force and inclination that its vertical component is sufficient to overcome the bird's weight, while its component facing the wind is sufficient to overcome the resistance of the bird in that direction, or its drag, the apparent phenomenon of the bird advancing indefinitely against a strong wind without loss of height is explained.

(*To be continued*)

Two More Records Broken By the I. M. A. C.

In the Illinois Model Aero Club's last meet of the year (September 25, 1921) two records were broken—the hand launched twin pusher for duration, which was raised to 265 seconds, and the "rising-off-ground" for the same type of model now stands at 209.4 seconds. Both these records are claimed by Robert Jaros.

At the club meeting of October 7th, Major R. W. Schroeder gave a most interesting talk on his altitude flights and the Gordon Bennett race.

The annual banquet and other indoor activities will keep the club members busy during the cold months.

A Glider-sled of Novel Design

A report has reached this country that an enterprising manufacturer in Germany has put into production an ingenious glider-sled which will be sent in quantities to the United States. It is said that the features of this device are a pair of very efficient monoplane wings, of rather short span, projecting from either side of a rather conventional coasting sled.

The idea is not new, but it appears to be practically developed and should provide a good deal of sport for skillful coasters. The wings are so arranged that, when a good speed has been attained in coasting, they may be tilted so as to lift the sled right off the ground and continue in the air for quite a distance, depending, of course upon such considerations as the weight of the rider, the smoothness and steepness of the hill, etc. The principle could be used to advantage by experimenters in soaring flight and gliding flight, for the most difficult part of such experiments is to get the initial speed to start—this idea seems to possess good points in that respect, and because of the greater safety to be found in landing in snow rather than on hard earth.

Would Promote Gliding Contests

Efforts are being made by W. H. Logue, Jr., 931 North Broadway, Baltimore, Md., to arouse interest in national competitive gliding contests.

The success attending experiments with motorless aircraft in France and Germany, said Mr. Logue, has brought home a realization in this country that no advancement has been made in the United States with regard to such steps. In Baltimore, he said, are many young men who should be able to take an active interest in a craft capable of remaining aloft without an engine.

Young men in Baltimore (and in other cities also) are invited to communicate with AERIAL AGE in regard to such contests, and efforts will be made to cooperate with them for the purpose of establishing a basis upon which satisfactory contests can be arranged.

A-E-R-O-N-I-T-I-S

The Knocker

When the Creator had made all the good things there was still some dirty work left to be done, so he made the beast, the reptiles, and the poisonous insects, and when he had finished there were some scraps left over that were too bad to put into the rattlesnake, the hyena, the scorpion and the skunk, so he put all these together, covered it with suspicion, wrapped in jealousy, marked it with a yellow streak and called it a *Knocker*.

This product was so fearful to contemplate that he had to make something to counteract it, so he took a sunbeam, put in the heart of a child, the brain of a man, wrapped these with civic pride, gave it a mask of velvet and a grasp of steel and called it a *Booster*. Made him a lover of fields and flowers and of manly sports, and a believer in equality and justice, and ever since these two were made *The Knocker* and *The Booster*—mortal man has had the privilege of choosing his own associates.

A Sailor's Lament

If my wish could be granted
From Somewhere overhead,
I'd wish to be an oyster
And always stay in bed.
—*Golden Gate Sentinel.*

OFFICER (*drilling recruits*): Hey, you, in case of fire, what do you do?

RECRUIT: Yell.

OFFICER: Yell what?

RECRUIT: Why, what do you suppose? Cease firing.
—*Blue Hen Weekly.*

That Grand and Glorious Feeling

Didya ever get up in a ship and when you're high enough so that you can be trusted, the instructor says, "She's all yours," and you take the stick and try to give her enough right rudder to overcome the torque and by that time the nose is either up or down or the wings aren't level, and by the time you correct those minor details she is drifting off sideways, somewhere, didya? And after you sweat blood for a while and go from rotten to rottener, the instructor grabs the stick and sets her level and directs you, in the name of all that's holy to keep her that way, and you don't and he makes a few choice remarks as to the amount of gray matter you are endowed with, and the horizon gets the St. Vitus dance, and the wings absolutely refuse to stay put, and the instructor tells you you are a goof, which is superfluous, because you've known that for some time. Just about then your instructor's remarks are hot enough to scorch the tail surfaces and you wish you had a transmitter on the Gosport phone so you could come back at him and you resolve to hide it somewhere tomorrow; didya ever notice that just about then you get mad and pull yourself together and manage to hold her level for a minute or two and you find it's not so bad after all. Just then, if your instructor nods his approbation, Oh, Boy, ain't it a gran' an' glorious feelin'?—*Carlstrom News.*

A Freshman just in from Hong Kong
Bought a race-about Ford for a song.
The tires weren't new
And the spark plugs were two
But you should have seen Hong tear along.

Friend, to driver of Ford (after narrow escape at crossing):

"Why didn't you insist on your right of way with that car? If the case went to court, they wouldn't have had a leg to stand on."

"Neither would we."

FIRST SWITCHBOARD OPERATOR: What did you say to that shimmie artiste?

SECON'D S. O.: Looks as if all trunk lines were busy.

Walking On Air

"Have you seen the tight rope walker?"

"No; where did he get it?"—*Widow.*

HALF: That coach is a wonderful conversationalist.

BACK: He ought to be—he spends the whole season improving his line.—*Banter.*

I kissed a girl on her soft, white hand,
I said her heart was hard.
I kissed that girl on her soft red lips,
Gosh, but her hand was hard.
—*Harvard Magazine.*

"Why is a woman like an umbrella?"

"Oh, go on, tell me quick."

"Well, every man ought to have one and not borrow his neighbor's."—*Mugwump.*

Academic Training

A wealthy Irish farmer, intending to send his son to college, wrote a letter to the "Head Master of Oxford University," in which he said: "Please say what are your terms for a year; and will it cost anything extra if my son learns to write a good hand and spell proper, as well as to row a boat?"
London Weekly Telegraph.

Nothing But the Truth

LAWYER: And what was the defendant doing meanwhile?

WITNESS: He was telling me a funny story.

LAWYER: Rememher, sir, that you are under oath.

WITNESS: Well, anyway, he was telling me a story.
Pearson's Weekly (*London*).

Offn 'Em for Life

Times were hard and Mrs. Johnson was endeavoring to get her lord and master to enter some gainful occupation.

"It's a good job," she argued. "Fo' and a half dollars fo' eight hohs a day."

"Who dis man, tryin' to th'ow money at me dat way?"

"Tom Wilson."

"Tom Wilson? No, ma'am; somebody else, not me. Ah done wo'k two yeahs in France fo' dat Wilson family."
—*Legion Weekly.*

Still a Chance

Caddie (to golfer badly bunkered, with opponent well on the green): Don't give up the hole, sir. You never know; the other gentleman might have a fit.—*Boston Transcript.*

He Had His Doubts

An elderly man was persuaded by one of his sons to go with him to a boxing exhibition.

The son paid for two $2 seats.

"Now, dad," said the son joyfully, "you'll see more excitement for your $2 than you've ever seen in your life before."

The old man grunted.

"I've got my doubts about that," he said gloomily. "Two dollars was all I paid for my marriage license."

Of Course

Some poker players claim that they
Are lucky as can be,
But a manicure holds bigger hands
Than many that we see.
—*Los Angeles Examiner.*

The Balancer

Scorn, if you will, the lowbrow how,
Aye with a knife his peas doth eat;
But give the devil his just due;
Admit—it is a dextrous feat!
—*Judge.*

"Recently there appeared in a country weekly the following advertisement: 'If John Jones who deserted his wife and baby some 20 years ago, will return, the said baby will knock the stuffing out of him.'"—*The Shield.*

A Sad Case

NORTH: Webster was injured in government service.

WEST: Wounded in the war?

"No. He worked in the rehabilitation department and fell out of his desk chair while asleep."
—*New York Sun.*

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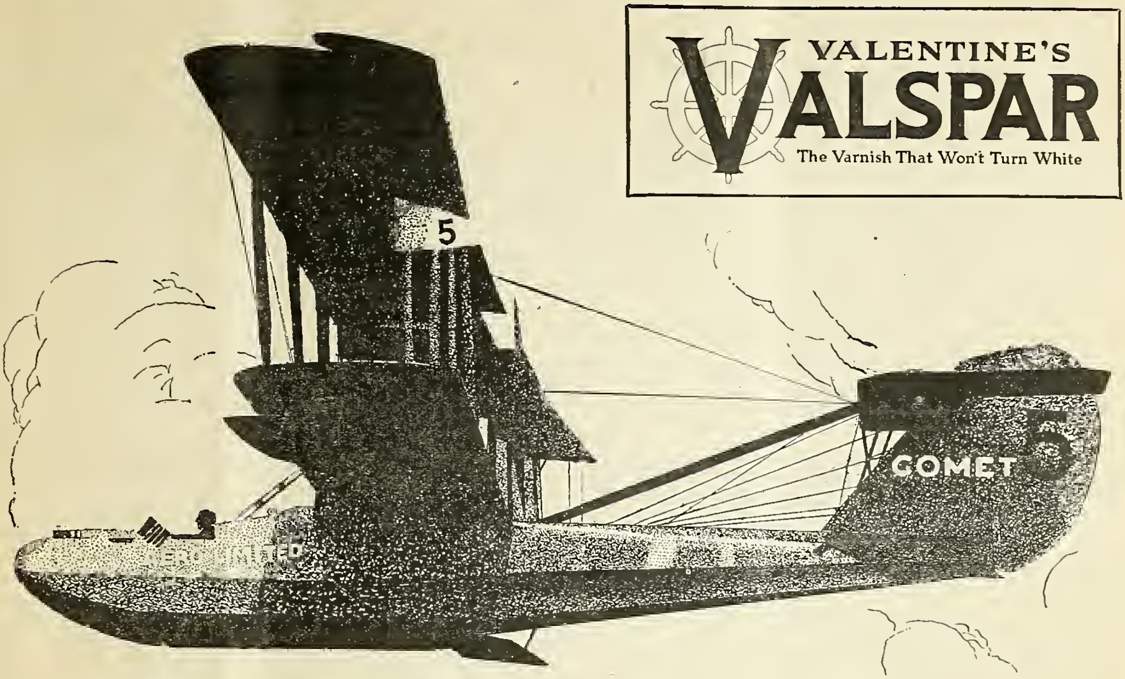
VALSPAR
The Varnish That Won't Turn White



Submerged, four months—

FLYING down from New York to Miami last December, the Aero-Limited Company's hydroplane "Comet" developed motor trouble off Chincoteague, Va. The motor was removed and sent to Miami—the plane left anchored in Chincoteague Harbor.

It was not until May 18th that the Company learned the "Comet" had sunk sometime in January, and save for the upper wing, had remained submerged since that time.

The ship was raised and an unsuspected leak in a vent tube stopped. As soon as the new motor was installed, the plane was flown to Flushing Bay, Long Island, without further repairs or even re-varnishing. For careful inspection showed that despite the four months' submergence in salt water, *the wings were still absolutely taut, the hull in perfect condition—the varnish unaffected.*

Astonishing? Not when you remember that "Comet," like all "Aero-Limited" planes, was

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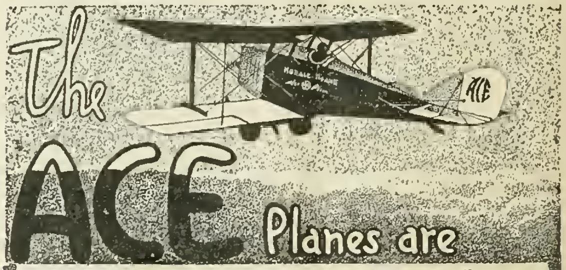

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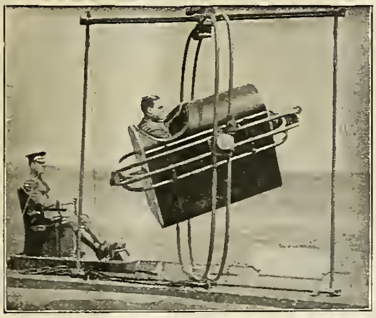

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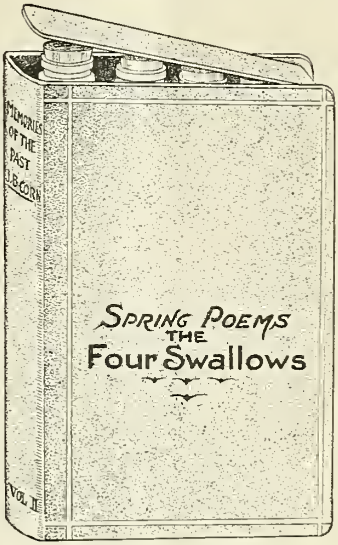
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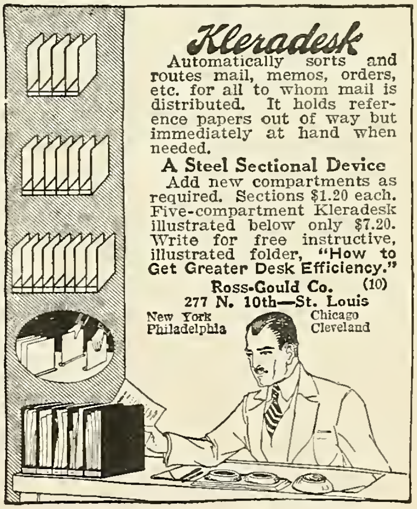

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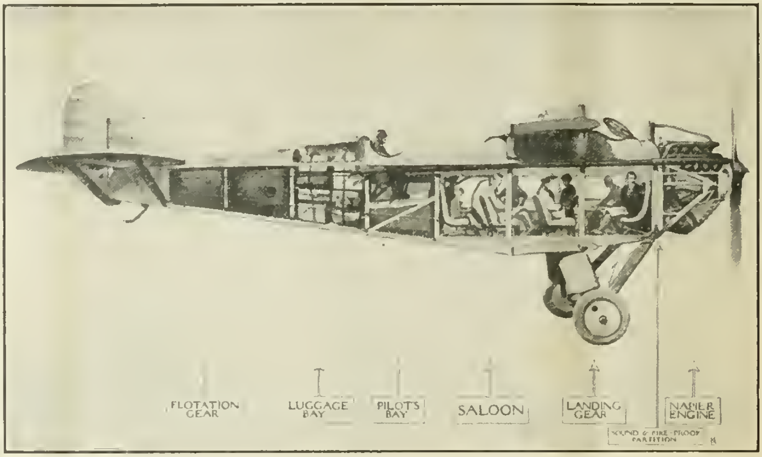

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Principles of Airplane Design

By George Marshall Denkinger, Research Aeronautical Engineer, Air Service, U. S. A., and Clarence Dean Hanscom, formerly Research Aeronautical Engineer, Air Service, U. S. A. (In preparation. Ready Spring, 1921.) Vol. I. Theoretical and Experimental Aerodynamics. Contents.—Aerodynamics. Wind Tunnels. Wings. Resistance. Vol. II. Applied Aerodynamics. Contents.—Estimation of Performance. Stress Analysis. Weight Estimation. Air Screws. Motors. Materials of Construction. [Wiley.]

Aeronautics—A Class Text

By Edwin Bidwell Wilson, Ph.D., Professor of Mathematical Physics in the Massachusetts Institute of Technology. 265 pages. 6 by 9. 31 figures. Cloth. Postpaid $4.25.

Covers those portions of dynamics, both rigid and fluid, which are fundamental in aeronautical engineering. It presupposes some knowledge of calculus. The book will prove stimulating to other than technical students of aeronautical engineering. Contents.—Introduction. Mathematical Preliminaries. The Pressure On a Plane. The Skeleton Airplane. Rigid Mechanics. Motion in a Resisting Medium. Harmonic Motion. Motion in Two Dimensions. Motion in Three Dimensions. Stability of the Airplane. Fluid Mechanics. Motion Along a Tube. Planar Motion. Theory of Dimensions. Forces On An Airplane. Stream Function, Velocity Potential. Motion of a Body in a Liquid. Motion in Three Dimensions. Index. [Wiley.]

The Dynamics of the Airplane

By K. P. Williams, Ph.D., Associate Professor of Mathematics, Indiana University. (No. 21 of Mathematical Monographs. Edited by Mansfield Merriman and Robert S. Woodward.) 138 pages. 6 by 9. 50 figures. Cloth. Postpaid $2.75.

An introduction to the dynamical problems connected with the motion of an aeroplane, for the student of mathematics or physics. While not written for the person interested mainly with design and construction, most of the questions treated have some interest for anyone who is familiar with the entire field of aeronautics. The development of the French writers is followed more closely than that of the English and American, the author believing that it is worth while to make a treatment of this general sort accessible to American students of mathematics. Contents.—The Plane and Cambered Surface. Straight Horizontal Flight. Descent and Ascent. Circular Flight: 1. Horizontal Turns. 2. Circular Descent. The Propeller. Performance: 1. Ceiling. 2. Radius of Action. Stability and Controllability: Longitudinal Stability. Stability in Rolling. Lateral Stability. [Wiley.]

Learning to Fly in the U. S. Army

By E. N. Fales. 180 pages. 5 x 7. Illustrated. Postpaid $1.75.

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Aircraft Mechanics Handbook

By Fred H. Colvin, Editor of American Machinist. 402 pages. 5 by 7. 193 illustrations. Postpaid $4.25. New Edition.

A book specifically for the aircraft mechanic. During the war it was extensively used as a textbook in the U. S. Navy Training Stations, the Army Flying Fields and Schools of Military Aeronautics. It covers briefly the principles of construction, and gives in detail methods of erecting and adjusting the plane. The book is especially complete on the care and repair of motors. Descriptions of the various types of military aeroplanes and engines are given. The photographs and cuts show the principles and practice of adjustment and operation. [McGraw.]

Airplane Design and Construction

By Ottorino Pomilio. 403 pages. 6 by 9. Illustrated. Postpaid $5.25.

This was the first book to be published in this country which presents in detail the application of aerodynamic research to practical aeroplane design and construction. Although the feat of flying in a heavier than air machine was first accomplished in America, the major part of experimental work in aerodynamics has been conducted in Europe. The Pomilios of Italy have had an important part in this experimental work. The data presented in this book should enable designers and manufacturers to save both time and expense. The arrangement, presentation of subject matter, and explanation of the derivation of working formulae together with the assumptions upon which they are based and consequently their limitations, are such that the book should be indispensable to the practical designer and to the student. [McGraw.]

Radio Engineering Principles

By Henri Lauer, formerly Lieutenant, Signal Corps, U. S. A., Assistant in the Preparation of Training Literature on Radio Theory and Equipment, and Harry L. Brown, formerly Captain, Signal Corps, U. S. A., in charge of the Preparation of the Technical Training Literature used in the Signal Service. 304 pages. 6 by 9. 250 illustrations. Postpaid $3.75.

This is the first book to bring the science of radio up to date—to include the wonderful developments made during the war. In no other book published in this country is there such complete information on vacuum tubes. About one-half of Lauer and Brown's "Radio Engineering Principles" is devoted to the discussion of the three-electrode vacuum tube, taking up its use as detector, amplifier, oscillator and modulator. The book covers thoroughly the operation and characteristics of two- and three-electrode vacuum tubes, the practical applications of the tubes, the generation and control of electron flow, and the conditions which must obtain to cause a tube to operate in any of its functions. Aeroplane and submarine radio theory is discussed in detail. Other special applications of the vacuum tube are also treated. Lauer and Brown's "Radio Engineering Principles" is the authoritative modern textbook on the subject. [McGraw.]

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Aeroplane Design

By F. S. Barnwell. With a Simple Explanation of Inherent Stability—By W. H. Sayers. With diagrams. Postpaid $1.10.

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Flying Guide and Log Book

By Bruce Eytinge. With a Foreword by H. M. Hickam, Major, Air Service. 1921 edition, enlarged and revised to date. 150 pages. 4¾ by 7¼. 38 illustrations, including many photographs of landing fields, and a 24-page Pilot's Log Book for Machine, Motor and Flying. Cloth. Postpaid $2.75.

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VOL. XIV, No. 14

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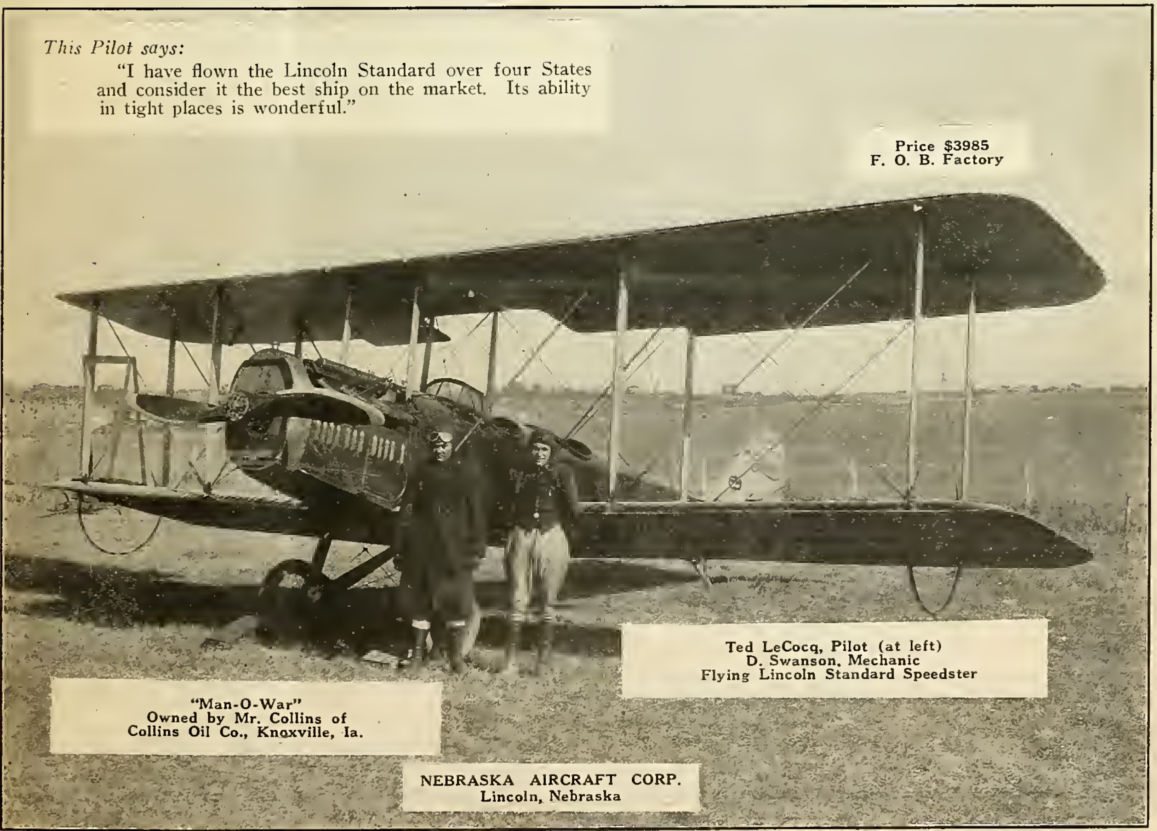

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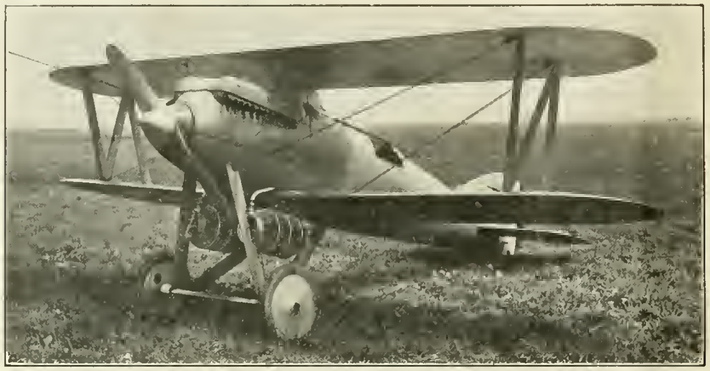

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Admiral Sims on Aircraft

THE joint Army and Navy Board, reporting upon the aerial bombing tests off the Virginia Capes, declared that "the battleship is still the backbone of the fleet and the bulwark of the nation's sea defense." If an address just made by Admiral William S. Sims, President of the Naval War College, is correctly reported, he took issue with the joint Army and Navy Board and squarely disputed its conclusion. "The battleship," he is quoted as saying, "is no longer the backbone of the navy. The battleship has no defense against aeroplanes and no offensive power against aeroplane carriers which have speed enough to keep away."

In the proposals of Secretary Hughes for limiting naval armaments an aeroplane carrier allowance of 90,000 tons was fixed for the United States and Great Britain, and 54,000 tons for Japan; but no attempt was made to restrict aeroplane construction. The limitation of naval aircraft was considered impracticable, since naval aircraft could be readily adapted "from special types of commercial aircraft." As the army bombers that sank the former German dreadnought *Ostfriesland* flew at least one hundred miles from an inland aviation field to attack the warship, it seems to have been demonstrated that no hostile fleet could venture to approach near the coast of a nation strong in commercial aviation. The joint board evidently recognized this, for it said that if the navy commands the sea routes, the lines of traffic can be kept open without entering the area of the enemy's coast zone which is controlled by aircraft bases on shore. The report went on to say that if heavier-than-air craft were to be effective in naval warfare they must operate from carriers.

It was then contended that as carriers could be attacked by vessels armed with guns, torpedoes or bombs, they would have to call upon the battleship for protection eventually. This was reasoning in a circle, and was really an avoidance of the question whether, on the offensive, aircraft would not be superior to the battleship in destructive power. Admiral Sims has been quoted above.

The greatest speed of British battleships is 25 knots. The maximum speed of any American battleship in commission is 22 knots, which the *Florida*, a 12-inch-gun ship, has attained. Our most powerful battleship, the *Maryland*, was built to steam 21 knots, but has exceeded it somewhat on her trials. Thirty-five knots for an aeroplane carrier is feasible. It has been said that a carrier of 30-knot speed could keep out of the range of any known gun of a battleship and launch her bombing planes to attack the battleship. A satisfactory defense against aeroplanes may be devised, but none exists today. So it comes to this: granting that carriers themselves might succumb to attack from the air and from torpedoes launched by submarine or destroyer, the battleship would always be in danger of destruction in mid-ocean so long as the swift carrier kept the sea.

Admiral Sims's conclusion is stated to be that the nation controlling the air will control the surface below, and that supremacy in the air will determine victory. He shares this view not only with French and British naval officers, but with officers of high rank in our own service. The question arises whether the conference at Washington will not eventually be forced to go deeper into aircraft limitation.—*Editorial in N. Y. Times.*

The Abandoned Naval Reserve

EXPERTS disagree as to the possibility of a "next war," but they agree absolutely that if the next war does come, it is likely to be on the seas and in the air. We are warned that we must have adequate naval and air forces. We must have adequate reserves. Yet in spite of these warnings, the paid personnel of the Naval Reserve Force has shrunk in the last few weeks from 230,000 to nothing. The Naval Reserve, in which hundreds of thousands served faithfully and valiantly during the war, has practically been abolished by Congress, which failed to appropriate enough money to pay the meager retainer fees of personnel. The Navy Department, asserting that it had no alternative, discontinued the paid reserve. All members were disenrolled, having only an opportunity to join Class 6 of the reserve, a class in which personnel is not paid no matter how much time may be devoted to drills and maneuvers.

Thousands of reserve sailors went on cruises this summer at Navy expense, receiving only Navy pay and training, which is more valuable to the Navy than to the reserves. To disenroll these men is to waste their summer's work, yet they have been disenrolled.

Toward the close of the world war, thousands of men joined the Naval Reserve who were trained after the Armistice. All that training seems lost to the Navy. Many reserves recently "shipped over" after expiration of their enrollment. Good intentions have not been considered.

The Navy appreciates the Reserve Force. The reserves appreciate that the Navy needs them. Only Congress seems unaware that there is in time of war a need for trained sailors outside for permanent forces.—*American Legion Weekly.*

The News of the Week

Helium a Success in Airship Tests

Norfolk, Va.—By three flights with her bag filled with helium, the big navy dirigible C-7 has proved that the newly discovered gas can be used by lighter-than-air flying machines. Helium is non-inflammable.

The C-7 was up in the air twice Dec. 1 and once Dec. 2. She was scheduled to fly to Washington, but the weather interfered. The big blimp came to earth when it began to rain. The C-7 will fly to Washington, where she will be inspected by Assistant Secretary of Navy Roosevelt and by all the ordnance experts of the army and navy.

The C-7 was piloted by Lieut. Commander R. F. Wood, in charge of lighter-than-air work at the base. On the first flight there were also aboard Lieut. Commander Zachary Lansdowne and Lieut. C. E. Bousch of the Bureau of Aeronautics of the Navy Department and Chief Machinist Mate Farriss, who was engineer.

The helium used in inflating the C-7 is the product of the Government's plant at Fort Worth. Helium can be made in commercial quantities only from the oil obtained from certain wells in Oklahoma and Texas fields, and the United States, if necessary, can prevent other nations from obtaining it and thus possess great military advantage over them. The plant at Fort Worth, which cost several million dollars, was built during the war and is now under the joint operation of the army and navy. Helium is separated from the other gases in the oil by means of complicated refrigerating apparatus and the process is costly.

Helium has 92 per cent. of the lifting power of hydrogen and does not escape so readily. Though blimps are made of practically air-tight material, considerable gas seeps through and goes to waste. Helium is but 62 per cent. as diffusive as hydrogen. It has also the advantage that it does not deteriorate so rapidly. When hydrogen is kept long in a blimp it becomes impure and must be released. Helium does not absorb impurities so rapidly.

Spain to Argentina Air Line Projected

The Spanish Parliament is practically certain to sanction very soon the granting of a subsidy to an air company operating passenger and mail Zeppelins between Cadiz and Buenos Aires, making the trip between the two cities in ninety hours, according to an announcement by Dr. Hugo Eckner, manager of the Zeppelin works in Friedrichshafen, who has just returned to that city after a tour of South America, during which he studied conditions as applying to an air service.

The enterprise is purely Spanish, but the organization and management will be German.

Dr. Eckner declared that war experiences were such as to enable his company to guarantee the smooth operation of airships of 45,000 cubic feet in size at a rate of speed of seventy-two miles an hour while carrying between thirty and forty passengers and 300,000 letters.

The idea of the Cadiz-Buenos Aires service originated in Spain, he said, the Spaniards being anxious to establish a quick and direct connection with Spain's one-time trans-Atlantic children. Spanish negotiations with the Zeppelin management led to the organization of a commission, which has already provided 50,000,000 pesetas (about $10,000,000) of the necessary 80,000,000 pesetas (about $16,000,000), the Spanish Government guaranteeing the interest on this sum.

Speaking before the Argentine Aero Club and the German Club in Buenos Aires, Dr. Eckner emphasized the point that danger from thunderstorms and lightning did not exist for airships, since they were able to dodge tempests. He declared that excellent wind and weather conditions greatly favored the route proposed, which is 6,000 miles long.

The return journey from Buenos Aires to Cadiz will require a hundred hours, owing to the northeast winds that will be encountered.

Dr. Eckner said there were favorable terrain conditions at both ends of the route, particularly in Spain, which will facilitate hangar building. He expects that the entire capital stock of the company will be earned within two years.

It is proposed that the service will be inaugurated with three airships, which will cost 36,000,000 pesetas (about $7,200,000), and hangars, gas factories and wireless installations, costing 40,000,000 pesetas (about $8,000,000), while unforeseen expenses are calculated at 4,000,000 pesetas (about $800,000).

The expense in connection with each trip will be about 42,000 pesetas (about $8,400), and it is estimated the receipts will be about 900,000 pesetas (about $180,000) based on carrying sixty passengers at 5,000 pesetas (about $1,000) each, and 300,000 letters at 2 pesetas (about 40 cents) each.

New Plane Tested

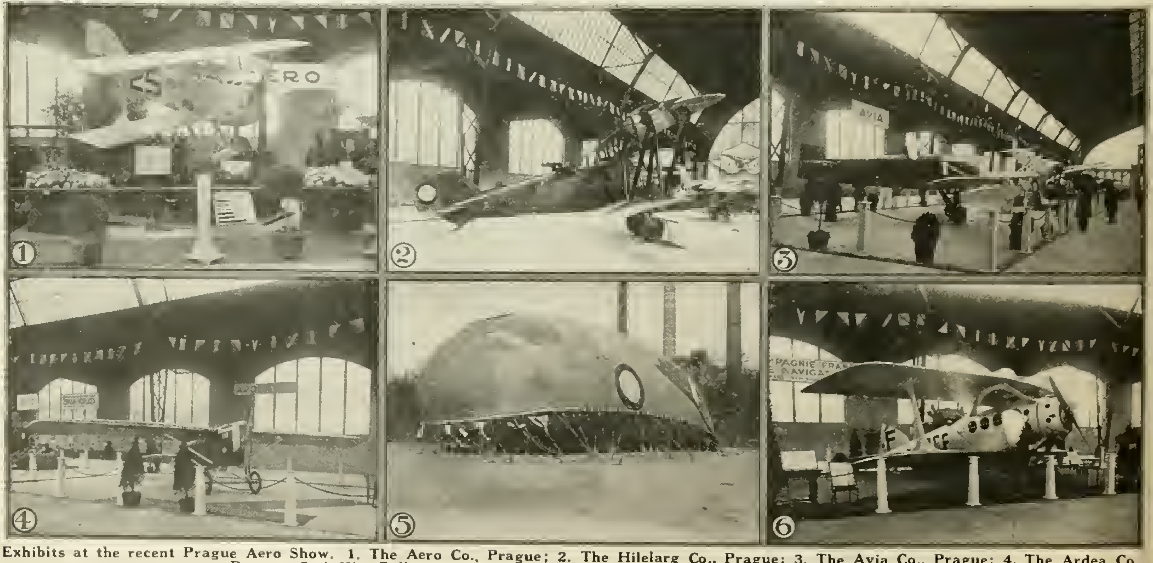
The Davis-Douglass torpedo plane, built in Los Angeles, was given a number of preliminary trials by the Fleet Air Force Monday. The ship is equipped with a 400-horsepower Liberty engine and embodies a number of new features in torpedo-plane construction, particularly the shape of the wing sections and manner in which the torpedo is carried and fired.

91st Aero Squadron Will Get New Planes

Twenty military airplanes have been ordered from the aeronautical supply base at Rockwell Field for the fliers of the 91st Aero Squadron based at Crissy Field, San Francisco.

The planes include two British spads, two British S. E. 5's, ten De Havilands and six Curtiss training ships equipped with Hispano-Suiza motors.

Officers of the 91st squadron will go to San Diego from San Francisco to fly the ships to the northern field when they are ready.



Exhibits at the recent Prague Aero Show. 1. The Aero Co., Prague; 2. The Hilelarg Co., Prague; 3. The Avia Co., Prague; 4. The Ardea Co., Prague; 5. A Kite Balloon in the Show Grounds; 6. The Campagnie Francais Arienne

PULITZER TROPHY RACE

CONTEST COMMITTEE REPORT
OMAHA, NEB., NOV. 3, 1921

Course—Triangular, 30.7191 Miles
5 Laps—153.595 miles

PLACE	PILOT	NUMBER	PLANE	ENTRANT	1st LAP			2nd LAP			3rd LAP			4th LAP			5th LAP			TOTAL			MOTOR		Drive	Ignition	Propeller	Carburetor	Oil	FUEL		Spark Plug	INSTRUMENTS			TIRES
					Time		Av. Speed m.p.h.	Time		Av. Speed m.p.h.	Time		Av. Speed m.p.h.	Time		Av. Speed m.p.h.	Time		Av. Speed m.p.h.	Time		Av. Speed m.p.h.	Type	H.P.						Gasoline	Benzol		Tachometer	Altimeter	Speed Indicator	
					min.	sec.		min.	sec.		min.	sec.		min.	sec.		min.	sec.		min.	sec.															
1	Bertrand Acosta	4	Curtiss Navy Biplane	Curtiss Co.	10	32.8	174.76	10	24.4	177.11	10	23.2	177.45	10	22.4	177.68	10	25.6	176.76	52	8.4	176.75	Curtiss CD-12	400	Direct	B'rkshire Magneto	Curtiss	Stromberg	Castor	50%	50%	A C	Army Type D	Foxboro	Sperry	Goodyear
2	C. B. Coombs	3	Curtiss-Cox Triplane	S. E. J. Cox	10	41.8	172.31	10	43.0	171.98	10	57.2	168.27	10	52.0	169.61	10	52.2	169.56	54	6.2	170.34	Curtiss C-12	400	Gear 3 to 5	B'rkshire Magneto	Curtiss	Stromberg	Castor	50%	50%	A C	Army Type D	Foxboro	Sperry	Goodyear
3	J. A. MacReady	2	Thos. Morse MB-6 Biplane	Thos. Morse Corp.	11	31.2	159.99	11	23.8	161.73	11	28.2	160.69	11	27.6	160.83	11	29.6	160.36	57	20.4	160 72	Wright H-2	300	Direct	Dual Dixie	McCook Field		Woolfs Head 8	40%	60%	A C	Van Sicklen	Tycos	Precision	Goodyear
4	Lloyd Bertaud	27	Balilla Biplane	Aero Import Co.	12	36.8	146.13	12	01.6	153.25	12	19.2	149.61	12	18.4	149.77	12	17 4	149.97	61	31.4	149.79	Curtiss C-12	400	Gear	Standard	Curtiss 4-Blade	Standard	Castor & Mobile-B	50%	50%	Mosler	Standard	Sperry	None	
5	Jas. Curran	6	S. V. A. Biplane	Ralph Diggins Co.	17	38.0	104.53	17	11.6	107.20										34	49.6	105.85	S.P.A.	220	Direct					100%						
a6	H. E. Hartney	1	Thos. Morse MB-7 Monopl'e	Thos. Morse Corp.																			Wright H-2	300	Direct	Dual Sims	Thomas Morse	Stromberg	Woolfs Head 8	40%	60%	A C	Van Sicklen	Tycos	Precision	Goodyear

*a*Forced landing on first lap near Loveland, Iowa, due to failure of fuel pump.

The above data is certified to be a true record of the result of the Pulitzer Trophy Race held Nov. 3, 1921, as taken from original reports of judges, timers, and other officials, made to the Contest Committee, and as accurately checked and accepted by such committee. The report of instruments and accessories used by contestants are believed to be correct. Any error in recording the instruments and accessories shown will be corrected and published upon proof that error has been made.

A. H. FETTERS, Chairman Technical Committee. IRA A. RADER, Chairman Contest Committee.

LARSEN TROPHY RACE

CONTEST COMMITTEE REPORT
OMAHA, NEB., NOV. 5, 1921

Course—Triangular, 30.7191 Miles
8 Laps—245.753 miles

Formula — $E = \frac{(W-T)\,S}{G}$

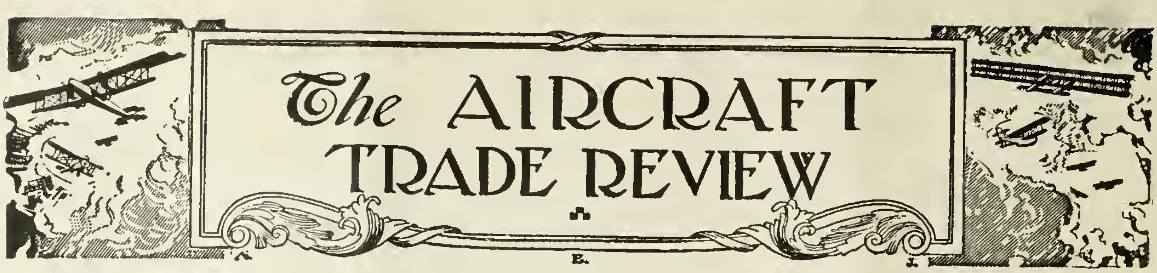
E = Factor of Efficiency
W=Total Load Leaving Ground—Lbs.
T=Light Weight of Plane + Water—Lbs.
W — T = Total Useful Load—Lbs.
S = Average Speed, M P H Actually Made.
G = Gallons of Fuel Actually Used.

Place	PILOT	Number or Symbol	PLANE	ENTRANT	TOTAL TIME		Av. Speed	E	W Lbs.	T Lbs.	W-T Lbs.	S m.p.h.	G Gals.	MOTOR		Drive	Ignition	Propeller	Carburetor	Oil	Fuel	Spark Plug	INSTRUMENTS			TIRES
					Min.	Sec.	m.p.h.							Type	h.p.								Tachometer	Altimeter	Speed Indicator	
c1	E. F. White	8	S. V. A.	C. B. Wrightsman	154	56.0	95.17	4671	2772	1600.	1172.0	95.17	23.88	S.P.A.	220	Direct	2-Marelli	Ansaldo	Zenith	Woolf Hd. ex.hvy."A"	Gasoline	Mosler	Jaeger	None	None	Pirelli
2	Max Goodnough	O	JL-6	J. M. Larsen	151	41.4	97.21	4640	4164.5	2446.	1718.5	97.21	36.00	B.M.W.	185	Direct	Bosch	J.L.	B.M.W.	Mobile-B	Benzol	Mosler	Sperry	Foxboro	Special J. L.	Goodyear
3	E. Stinson	No number	JL-6	J. M. Larsen	150	58.6	97.66	4212	4063.5	2446.	1617.5	97.66	37.50	B.M.W.	185	Direct	Bosch	J.L.	B.M.W.	Mobile-B	Gasoline	Mosler	Sperry	Foxboro	Special J. L.	Goodyear
b4	B. H. Pearson	aY	JL-6	J. M. Larsen	Did	not	finish		4182.5	2446.	1736.5			B.M.W.	185	Direct	Bosch	J.L.	B.M.W.	Mobile-B	Benzol	Mosler	Sperry	Foxboro	Special J. L.	Goodyear

*a*Yellow ship.
*b*Forced landing near Loveland, Iowa, on 6th lap, due to broken valve stem spring retaining washer; no other damage to plane.
*c*Decision appealed.

The above data is certified to be a true record of the result of the Larsen Trophy race held Nov. 5, 1921, as taken from original reports of judges, timers and other officials made to the Contest Committee, and as accurately checked and accepted by such committee. The report of instruments and accessories used by contestants are believed to be correct. Any error in recording the instruments and accessories shown will be corrected and published upon proof that error has been made.

A. H. FETTERS, Chairman Technical Committee. IRA A. RADER, Chairman Contest Committee.



The AIRCRAFT TRADE REVIEW

A. S. M. E. Annual Meeting

At the Aeronautic Section meeting of the A. S. M. E., on Friday morning, December 9, the following papers will be presented: "Study of the Elastic Properties of Small-Size Wire Cable," R. R. Moore; "Commercial Operation of Aeroplanes," Maj. L. B. Lent; "Problems of Commercial Operation in the Light of European Experience," R. B. C. Noordyn.

Pioneer Aero Company

The Pioneer Aero Company has been formed in Topeka, Kansas, to act as local distributors for the new Longren aeroplanes. The officers of the company are: Dr. F. C. Stewart, Eskridge, president; S. K. Beach, Eskridge, vice-president; Clayton P. Trivett, Eskridge, secretary-treasurer, and E. B. Lopp, Topeka, pilot and sales manager.

Aerial Photographic Maps

The *Engineering News Record* for October 13th contains an illustrated article on the subject of aerial photographic mapping developed for municipal and other engineering services. This article deals with recent developments in aerial mapping cameras and the excellent utility of mosaic maps in commercial use, since they show in considerable detail the objects and localities photographed. Touching on the subject editorially, the *Engineering News Record* comments as follows:

Engineers with a vision cannot fail to see in the development of the aeroplane photographic map a new tool with a wide variety of engineering uses. The mosaic map, however, has been so generally identified with war-time operations that its fields of application in civilian practice is just beginning to receive recognition. Both in the technique of aerial map-making and in the equipment employed therefore substantial progress has been made since the signing of the Armistice. Private enterprise, aided by governmental co-operation, has taken the development of the art where the army left it and carried it forward to a point of commercial practicability.

A number of cities today are using or planning to use aerial photographic maps in connection with such a wide range of engineering studies as city planning, traffic control, water-front improvements, transit facilities, location of new schools, street widening and fire protection. These, of course, are distinctly municipal uses, but in addition such maps offer possibilities in the preliminary investigation of watersheds, hydro-electric developments, highway, railroad or canal location, forest surveys, etc. Comparatively few engineers have sensed the application of the aeroplane map to the solution of many problems upon which they are now engaged. With such innovations as the automatic timing of exposures to cover the proper ground area and at the same time secure the necessary overlap for the accurate fitting together of individual negatives, lenses especially adapted to this type of work, development of the technique covering such details as the best height from which to take pictures for specific purposes, speed of the aeroplane, and the maintenance of a level flight to insure vertically in the view, the maps now being produced attain a high degree of accuracy and a wealth of valuable detail. Among the points worth considering in connection with aeroplane photography in engineering work are the speed with which such maps may be produced, their ability to cover territory inaccessible on foot, their comparatively low cost, and the impossibility of omitting any feature of the area photographed—the detail, of course, depending upon the altitude and the characteristics of the lens employed. Most of our larger cities are concerned with the problem of handling the ever-increasing volume of street traffic. In this field alone the aeroplane photograph offers extremely interesting possibilities.

The advent of the mosaic map, of course, does not mean that such time-tried tools as the transit and stadia or the plane-table are to be discarded. They have now, and always will have, a distinct field of usefulness. Aeroplane mapping, however, has already established itself as a practical means of securing quickly, cheaply, and accurately information which can be put to a wide variety of uses in engineering practice. Engineers who think of surveys only in terms of the old field tools may soon find themselves out of date.

Pioneer Instrument Company

The Pioneer Instrument Company announce that they have made a reciprocal agreement with R. A. Baden of Paris and his associated company, The Société Aréa, whereby Pioneer becomes the American and Canadian representative of this organization and the Baden Co. undertakes the distribution of Pioneer instruments in France.

Personal Par

Lt. W. J. Hoxworth of the Canadian Royal Air Force is now associated with the Hoxworth Oil & Gas Co. of Dallas, Texas.

Meetings Will Boom Commercial Aviation

To make plain the present possibilities and accomplishments of commercial aviation the Society of Automotive Engineers, numbering 5,000 members, is holding a series of meetings this month in cities throughout the country.

One meeting has been held in St. Louis; another will be held in Indianapolis today and a third on Friday in Worcester. The New York meeting will be on December 15, and Cleveland and Philadelphia will have meetings December 16 and December 22, respectively. Those taking prominent parts in the meetings include J. G. Vincent, who had much to do with the design and production of the Liberty motor; Glenn L. Martin, a pioneer in aviation; Ralph Upson, balloon expert; Assistant Postmaster - General Shaughnessy, in charge of air mail, and representatives of the Army and Navy air services.

Germans Back of Atlantic Air Line

Berne.—Hugo Eckner, manager of the Zeppelin works at Friedrichshafen, who has just returned from a trip to South America, said that negotiations between Spain and Argentina were expected to result in the opening of transatlantic air communications between southern Spain and South America.

He said the Zeppelin works was planning the construction of an airship of 15,000 cubic meters, capable of traveling seventy miles per hour, of carrying thirty or forty passengers, besides mail and small parcels between Spain and South America, and of making the trip in four or five days.

Herr Eckner predicted a complete revolution in commercial relations between Europe and South America by this means. He said a Spanish company was being formed to supply the necessary capital and that the technical organizing work would be done by Germans.

D'Annunzio Hopes to Visit U. S.

Gabriele d'Annunzio, Italy's poet-aviator, who became a figure in international politics as the result of his occupation of Fiume, has given through Major James E. Chaney, Assistant Military Attache at Rome, a message to the aviators of the United States, in which he says:

"While the wings of new Italy are racing over this reconstructed lake for the Cup of the Eagles offered by me, I send across the ocean my greetings and the greetings of all Italian aviators to our glorious American companions who with us are steering the aerial prow towards the promise of the future."

Major Chaney states that he met d'Annunzio September 25 at Lake Garda, on which day were staged the international races for the D'Annunzio Cup. D'Annunzio, since his return from Fiume, has led a secluded life in a villa at Gardone-Riviera, overlookiing Lake Garda.

D'Annunzio was extremely cordial, asked many questions about America, and seemed to have a most cordial feeling toward the United States, stating that he was anxious to go there sometime for some of our big aviation competitions. He is lame and has lost the sight of one eye. This due to an aviation accident during the war.

Lt. Bissel Transferred to Washington

Lt. Clayton S. Bissel, who has been on duty with the Field Officers' School, has received orders transferring him to the office of the Chief of Air Service, Washington, D. C.

THE PARIS AERO SHOW

WE are indebted to our contemporary *Flight* for the following interesting data and sketches of the exhibits at the recent Paris Aero Show. The management of *Flight* made valuable use of the Handley-Page airline in delivering its story and photographs from Paris to London. The material was handed in at the airline office at 10 a. m., Monday, November 14, delivered at 3:15 that afternoon at the publication office, and the issue of the paper with complete data appeared Thursday, November 17. We congratulate *Flight* on its achievement.

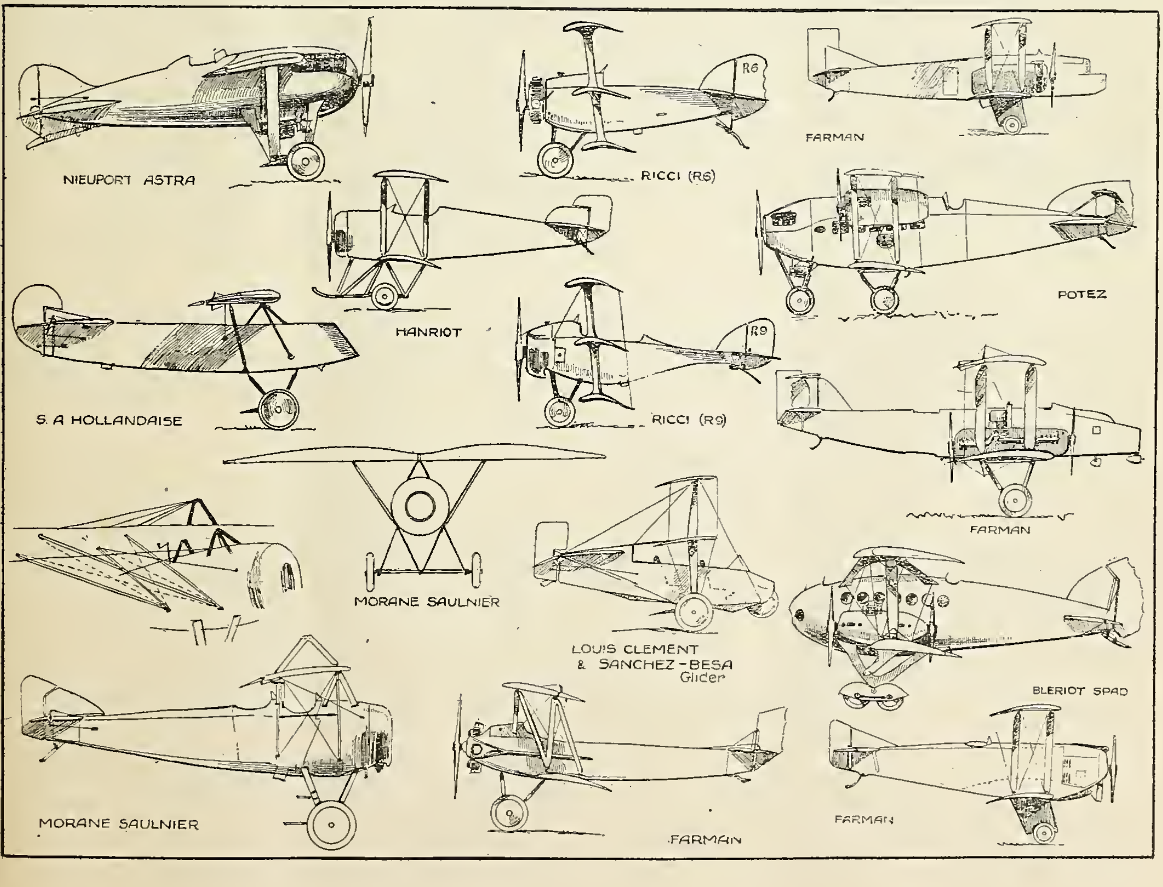
Large machines dominate this year's Salon. Although they are outnumbered by the smaller fry, their wings seem to cast their shadows over the whole of the Grande Nef, and to claim attention by their very size. Towering in some instances with the noses of their *fuselages* over the gazing pigmies walking below, they undoubtedly form the chief attraction as regards the general public. There is a steady stream of people climbing up the steps that lead to the "Pullman" cabins, and the queues remind one of London during the War. From the practical point of view, however, it is extremely doubtful whether these "Mammouths," "Leviathans," and "Juggernauts" deserve the prominence which their size gives them. There is still much to learn in a smaller way before we can profitably turn to these giants, and unless a full load can be guaranteed for each trip (which may be doubtful), they are likely to prove disappointing to run until flying becomes more popular with the general public than is the case at present. Regarded purely as aeroplanes, these large multi-engined machines are, of course, just as interesting as, if not more so than, the smaller ones, and from that point of view they will repay a close study. Also it should be borne in mind that France's policy in the air is vastly more vigorous than ours, and that the next few years will undoubtedly see an enormous increase in the already great extent of France's "airways." Some of these are planned for long distances, where the really large machine may prove more suitable. From the point of view of French constructors, therefore, it may well be that there are better prospects for the large multi-engined machines than one is at first inclined to think. It appears to the writer that we at home have gradually and, perhaps, unconsciously been slipping into the habit of thinking in terms of the London-Paris service, and that as a consequence we may be apt to lose sight of the far greater possibilities which are revealed when one looks farther afield.

From the constructional point of view, one's impression of the Show is that, although not a great deal of progress is evidenced, the general tone of the collection of some 40 machines is better than that of the Salon of 1919. There is a total absence of "freak" machines, and altogether the designs appear less the inspiration of artists and more the result of engineers' work than has previously been the case.

A good many examples of metal work are shown, indicating the increased interest which France is taking in this form of construction, but after a brief examination of these, one feels that the design is not yet on a par with that of England and Germany. It is true that several of the specimens are not new, although exhibited for the first time, and that this may account for them being of a form which was discarded long ago by us. Nevertheless, the fact of this revived interest in France should be a warning to us not to rest content with what we have achieved—even if it is only on a small scade—but to see to it that research work is not allowed to be dropped.

One thing which impresses one is that, although there are still several examples to be seen, the use of piano wire is far less general than has previously been the case, several constructors having abandoned it for streamline wire for the wing bracing. Hitherto, several French constructors have used piano wire for the wing bracing of even very large machines, with the result that the wire was often of very heavy gauge and most unsatisfactory when bent over and locked with a ferrule.

Among the larger machines the use of three engines seems to gain popularity. From the point of view of reliability, this arrangement is quite good, as the stoppage of one engine reduces the power by one-third only instead of by one-half. Also, the turning moment is, generally speaking, smaller for a given power in the three-engined type than in the twin. As



regards the efficiency the advantages are, perhaps, more problematical. The presence of a central tractor increases the drag of the main *fuselage*, owing to the slipstream, and it is said that in the case of one firm which has experimented with three-engined machines it was found that the machine was very little faster when the third engine was fitted than it was in its original form as a twin-engined machine.

If one's recollection serves, no French four-engined machine has ever been exhibited at the Grand Palais until the Blériot "Mammouth" was shown in 1919. This year there are two machines with four engines on the wings, and one with four in the *fuselage* driving a single tractor screw.

Of novelties there appear to be but few, but, generally speaking, the lack of these is more than compensated by the absence of "freaks" and the general improvement in design. As usual, the finish is, with few exceptions, excellent.

The absence of British machines is much to be regretted, the more so as the two examples shown indicate how well British products would have fared by comparison. The Vickers-Vimy Commercial with two Napier "Lion" engines is a very fine machine and well shown. It is sold to the Grands Express Aériens, and exhibited on the Stand of the Ateliers des Mureaux. The Bristol "Jupiter" radial air-cooled engine is a fine specimen of the British aero engine manufacturer's art, and is, with the Bristol Starter, attracting a great deal of attention from "those who know."

With these brief remarks we will leave general subjects and give a brief *résumé* of each of the machines shown.

Atéliers Des Mureaux

Although the banners over this Stand bear an unfamiliar inscription, the machine looks familiar enough, being the Vickers-Vimy Commercial with two Napier "Lions." Generally speaking the machine resembles the older type, except for minor alterations. The cabin is roomy and well lighted, and the comfort of the passengers has been well considered. The machine is to be used by the Grands Express Aériens, presumably on the London-Paris route. It is extremely gratifying to find a French firm using a British machine for their commercial service. In a subsequent issue of *Flight* we propose to give an illustrated detailed description of this machine.

Marcel Besson

This constructor, who has made a specialty of seaplanes, is showing a small single-seater flying boat of very unusual design. Of the type H.6, the machine is a tractor triplane with Clerget engine. The pilot sits aft of the planes, and consequently does not obtain quite such a good view as in a pusher boat. The planes are of very unusual arrangement, the lower having the greatest span and chord. The middle plane is shorter, while the top plane is quite a small affair. There is only a single strut on each side, and these have a pronounced inward slope. There are no flying nor landing wires, the more or less triangulated structure being apparently able to retain its shape without the use of bracing.

Blériot Aéronautique

Three complete machines are exhibited by Louis Blériot, all of the Spad type. By far the most interesting of these is the type 45, a large four-engined machine designed to carry 20 passengers. It is a vast improvement on the "Mammouth" shown in 1919, and bears unmistakable signs of M. André Herbemont's work. In spite of its large size, the machine has only one strut on each side, these being of the type found in nearly all the Spad-Herbemont machines, with cable bracing running to front and rear spars. The engines—400 h.p. Hispanos—are mounted in tandem on the wings. This is undoubtedly an improvement on the spread-out arrangement of the engines of the "Mammouth," and altogether the machine is, thanks to M. Herbemont's genius, a very much more practical proposition than was the older type. The use of only a single strut for a machine having four engines on the wings is somewhat startling, but the manner in which the design is carried out appears to be satisfactory, and in any case M. Herbemont is not likely to be led astray by captivating schemes unless he sees a practical solution for them.

In addition to the large machine, a small two-seater side-by-side school biplane is shown. This is the type Spad 34, with Le Rhone engine. It generally resembles the other Spads in its lines. A Spad "Berline" of the type used on the London-Paris service is also shown, but as this machine is already well known to readers of *Flight*, no reference is necessary beyond stating the fact of its presence.

Louis Breguet

The only new complete machine shown by Breguet is a type $19A^2$ all-metal biplane, designed as a fighter, with pilot in front and a gunner aft, equipped with a Scarff gun ring. The machine has only one strut on each side, and these appear to be of sheet duralumin with possibly a channel section stiffener inside. At the ends these struts are forked to meet the two wing spars. Owing, presumably, to the fairly small size of the lower plane, this machine is referred to as a "Sesquiplan." The power unit is a double-row Breguet-Bugatti of 450 h.p., and the machine is credited with a speed of 231 km./hours.

The "Leviathan" all-metal *fuselage*, which has been under construction for probably two years, has duralumin tube *longerons*, with frames of zigzag pressed duralumin bars similar to those of a Zeppelin, but not arranged as crosses. The bracing is by tie-rods. The power unit is a Breguet-Bugatti "Quadrimotem" similar to that shown in 1919. It has automatic clutches so that one or more of the units can cut out without interfering with the others. There is a single tractor screw formed by two two-bladers placed at right angles.

The *fuselage* of a type 14T bis "sanitaire" is also shown, and a five-passenger 14T bis of the old type. A wide seaplane float in duralumin is evidently designed for a large single-float seaplane.

Établissements Caudron

On the Caudron stand the largest machine is a three-engined cabin biplane with Hispano engines. The machine is not unlike that shown in 1919, but looks more refined. For instance, one is glad to note that streamline wing bracing is used instead of piano wire. The central engine is mounted in the nose of the *fuselage*, and the wing engines on the sides of the interplane struts, with supporting tubes running from the bottom plane up to the outer engine bearers. A four-wheeled undercarriage is fitted, and there is a small wheel under the nose of the *fuselage*.

A type C60, similar to that used by Poiree, is also shown, as well as one of the pre-War types with open tail booms. One notices that in the latter machine *ailerons* are fitted. The exhibits are completed by the *fuselage* of a C59 type, which appears to resemble the C60 except for having a Hispano engine.

H. and M. Farman

This is an imposing stand, chiefly owing to the presence of a huge four-engined machine. This is a biplane with 400 h.p. Lorraine-Dietrich engines placed in two pairs in tandem on the wings. The arrangement of the *ailerons* is unusual, the trailing edge of each *aileron* forming a separate hinged unit connected to the rear main spar by rods attached to cranks. The effect appears to be that when an *aileron* is moved down, its trailing edge tilts upwards and vice versa.

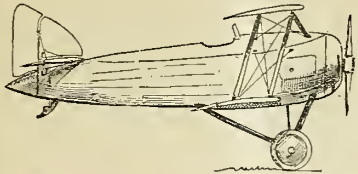
Farmans also show a torpedo-'plane, not unlike the famous "Goliath," but having a deep *fuselage* with open cockpits and a torpedo resting in a large semicircular groove in the floor of the *fuselage*. Apart from these differences, the machine is unlike the "Goliath" in having a single engine in the nose of the *fuselage*. A twin-engined machine with Salmson engines is also shown. This is practically a "Goliath" with minor modifications, notably an open cockpit in the nose of the *fuselage*, apparently intended for the navigator. A small "Farman Sport" completes the exhibits.

F.B.A.

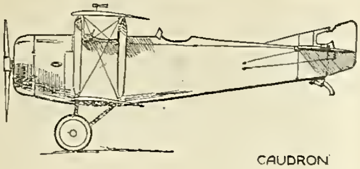
The Franco-British Aviation Co., of which M. "Beaumont," otherwise Lieut. Conneau, of Circuit-of-Britain fame, was a director, is exhibiting a fine piece of workmanship in the form of a fairly large boat hull, fitted with amphibian land gear, the wheels evidently being so arranged as to swing outwards under the bottom plane. A smaller boat hull is also shown, and a pair of wings, one in skeleton.

Avions Hanriot

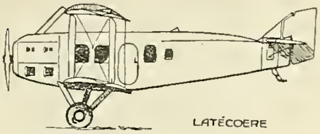
By far the most interesting machine on this stand is the all-metal racing monoplane built for, and which was to have been flown by Rost in the race at Etampes for the Deutsch Cup. This machine is a very fine piece of work and demands a full description, which we hope to publish in next week's issue of *Flight*, if possible with sketches of the detail construction. The *fuselage* is entirely covered with sheet aluminium, as are also the *ailerons*. The wings themselves are fabric-covered in the ordinary way, and might conceivably have given the same trouble as did those of the other machines. Otherwise we must admit that the Hanriot gives the impression of great strength, and it certainly looks capable of extremely high speeds. Everything is well streamlined, and the cantilever wings, although of deep section and consequently probably not of very high L/D., have no external bracing or fitments to offer extra resistance. One had hoped to see the machine shown with the retractable under-carriage but an ordinary one is fitted at the Show. The only other exhibit on the Hanriot stand which calls for reference is a type H.D.14 school machine. This has a rotary engine and a four-wheeled skid under-carriage.



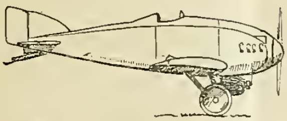
S.E.C.M.



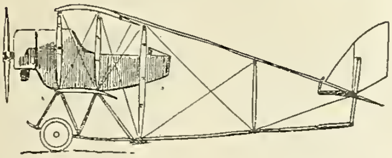
CAUDRON



LATÉCOERE



LIORE ET OLIVIER



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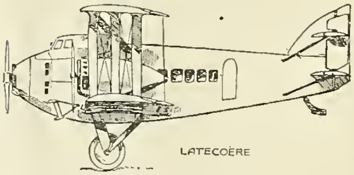
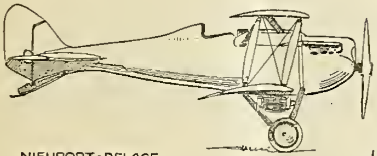
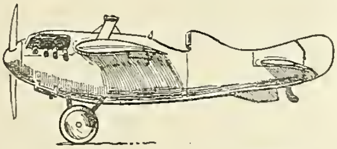


LATECOÈRE



NIEUPORT-DELAGE



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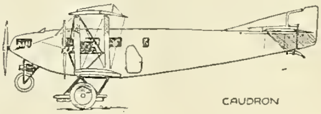

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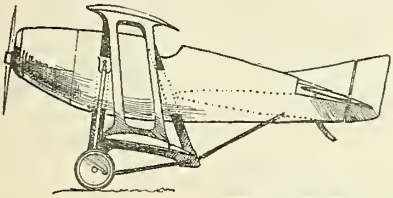
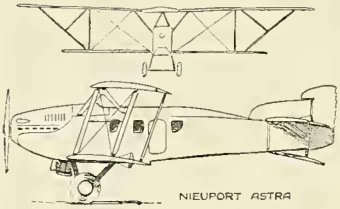


PIERRE LEVASSEUR



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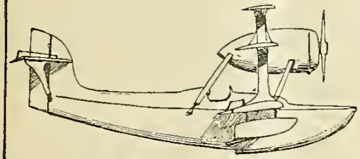

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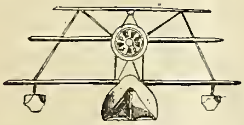
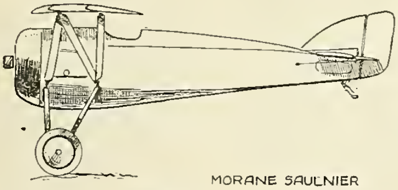
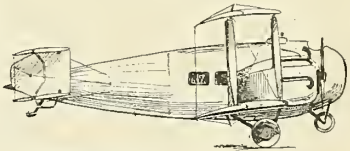
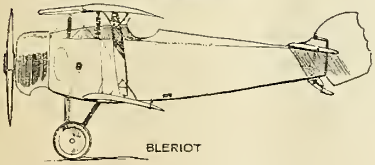




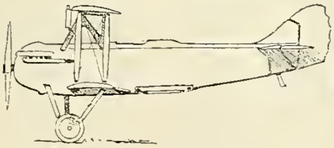
MORANE SAULNIER



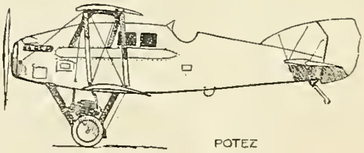
ATELIERS DE MUREAUX



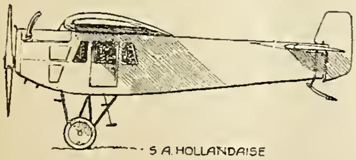
BLERIOT



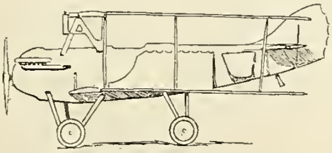
RENE TAMPIER



POTEZ



S A. HOLLANDAISE



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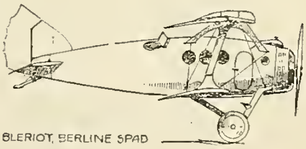
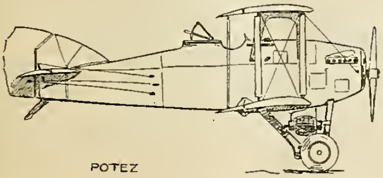


BLERIOT, BERLINE SPAD



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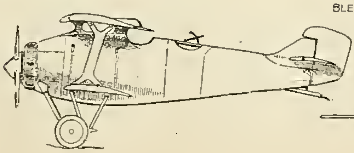

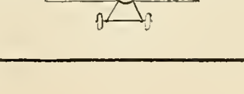

LOUIS BREGUET

Pierre Levasseur

Two interesting machines are shown on this stand. One is a torpedo-'plane, very much like the Blackburn "Swift." This machine is shown in skeleton, and gives a good idea of the excellent workmanship of this firm, of which M. Charles Fréchet is a director. M. Fréchet was French Liaison Officer in England during the War, and always makes English visitors welcome on the Levasseur stand. Needless to say, he speaks English fluently. The machine has the whole front portion of its *fuselage* built in steel tubing so as to form a strong separate unit. The engine is a 600 h.p. Renault.

The second machine shown is a side-by-side biplane, suitable for school work. It is of most extraordinary design, with a streamline body. The centre-section struts form a vee, with its apex in the central member of the undercarriage and the other to points on the spars of the top plane. The wings are in one piece, the lower being slipped between the chassis members. The rear portion of the *fuselage* is formed by two multiply members forming a kind of a wedge, the outer covering of the *fuselage* being merely a streamline casing taking no part of the load. The machine should be cheap to make and easy to repair. We shall refer to it in detail later.

A variable pitch propeller is also shown. This, we are informed, has just successfully passed its tests at the *Section Technique*, having completed a 10-hours' run. It was found that the pitch could easily be altered at all speeds up to the full speed of 1,800 r.p.m.

Latécoère

Lignes Aériennes Latécoère are showing two complete machines, and a huge *fuselage* in duralumin. The type Lat. 4 is a cabin machine with three Salmson engines, one in the nose of the *fuselage* and two on the wings. The total power is stated to be 1,000 h.p., so that the Salmsons are rated at 333 h.p. each. The cabin has room for 20 passengers and the total weight is given as being 7,000 kg. (about 15,000 lbs.). The machine is credited with a speed of 180 km. p. hour.

The second complete machine is of the type Lat. 8, with an enclosed cabin, and a single engine. The pilot is placed aft of the cabin. The machine bears the inscription "France-Spain-Morocco."

The large all-metal *fuselage* is for an "Avion de Protection" day-bomber, and must have cost a fortune to build. There are no *longerons* and struts, nor bracing, in the ordinary sense of the word. A number of longitudinal members are triangulated by diagonals running spirally around the streamline *fuselage*. All are of channel section, the diagonals having lightening holes in them.

Loiré et Olivier

This firm, which showed a very original three-engined flying boat in 1919, is represented by a single machine, a type LEO 9 "Avion Monoplace de Chasse." It has a thick high-lift monoplane wing placed at the floor of the *fuselage* à la Junkers. The wing is of uniform chord and thickness, and is of cantilever type. The front portion of the *fuselage* is covered in aluminium and there is a nice spinner over the propeller boss. Except for its cantilever wing the machine does not appear to have any remarkable features.

Morane-Saulnier

Only two machines are shown by M. S. this year, both parasol monoplanes. One is of the school type with wire bracing and is already well known. This was the type which was flown by Fronval with controls locked. It has also to its credit the flight from Paris to Bucharest with 4 landings. The engine is an 80 h.p. Rhone.

The second machine is an experimental monoplane with cantilever wings. These are chiefly remarkable for the fact that they are thin at the root and tips and thick at the point where the centre-section struts are attached. The machine, which is a single-seater, has been flown, but one understands that various minor modifications are still necessary before it is considered ready for series production. It is known as the M. S. type AU.

Nieuport-Astra

Three machines are exhibited, neither of them new. One is a cabin machine, biplane with thick wings and backward stagger, and appears to be the same as that shown in 1919, when it was announced that it was intended for the London-Paris service. An interesting exhibit is the "Sesquiplan," flown by Kirsch in the race for the Coupe Deutsch. This machine is very effectively mounted at a terrific angle of banking, reminding one very much of the late Commander Porte flying the "Thunderbug," at Hendon in the days before the War. The third machine is the type 29 biplane, which, although not new, is still one of the finest single-seaters in the world. Under the gallery is shown the car of an Astra airship.

Henry Potez

Compared with the machines exhibited at the last Paris Salon, the three Potez machines are a great improvement. One is a military two-seater of orthodox design, with a gunner's seat aft of the trailing edge of the wings. The engine is a 400 h.p. Lorraine mounted in the nose of the *fuselage* and driving a tractor screw.

A limousine is also exhibited, with cabin enclosed and the pilot placed aft of the cabin. The front portion of the *fuselage* has a generous curving of aluminium. This machine also has a 400 h.p. Lorraine engine, and is known as the type IX.

The most interesting machine on this stand is, however, the all-metal three-engined passenger machine. The two wing engines are mounted in Vees, under which occur the oleo undercarriages. A similar undercarriage is mounted under the nose of the *fuselage*, where is installed the third Hispano. The engines are of 150 h.p. each, and the machine should consequently be very economical to run. With regard to the detail construction we hope to have something to say in a subsequent issue.

Ricci Frères

This Italian firm is showing two diminutive triplanes, one a single-seater and the other a two-seater. At the moment, the span of the two machines is not known, but it only appears to be about 15 ft. Judging from a specimen bottom plane, the wings have but a single spar, and that only measuring about 1½ inches in depth by a thickness of approximately 1 inch. Although this may be sufficient for resisting bending stresses, it appears wholly inadequate for torsion. However, the single-seater type R 6 is said to have been stunted in Italy, and is shown without alteration, just as it looks after having made about 100 flights. The engine of this machine is a 6-cylinder 35-40 h.p. Anzani.

The two-seater type R 9, has a 50-60 h.p. Le Rhone engine, almost totally cowled-in, but appears otherwise very similar to the R 60. Both machines have this characteristic that towards the tail the *fuselage* changes from a rectangular to a triangular section. The consequence is a certain weakness in appearance, which is, however, probably more apparent than real. The machines are obviously the last word in lightness of construction, and should have a fairly good performance.

S.E.C.M.

The machine shown on this stand is a dual control, side-by-side school machine (Letece type XX). Its chief claim to attention appears to be that it is fitted up with navigation lights on the wing struts, and has a searchlight under the lower port wing and a windmill drive generator under the starboard plane.

Soc. An. Hollandaise de Constructions Aéronautiques

Otherwise known as N. V. Nederlandsche Vliegtuigfabriek is an "abreviation" of Fokker. This famous designer is showing an F3 230 Siddeley "Puma" engine. As this machine is already so well known from its work on the London-Amsterdam route no reference to it is necessary, beyond mentioning that an emergency exit has been provided in the roof, through an opening in the wing.

Fokker also shows a neat little cantilever monoplane glider, fitted with an ordinary two-wheeled undercarriage. Although engineless, this machine appears to retain all the Fokker characteristics, and one would know it for a Fokker anywhere.

Rene Tampier

On Friday last, as we approached the Grand Palais, we were treated to the strange sight of an aeroplane with folded wings travelling up and down the Avenue Alexandre III under its own power. That is to say, the propeller was not running, and the Hispano engine also seemed stationary. The machine made a good speed, and appeared to travel backwards as well as forwards. Steering was effected by a pair of wheels mounted approximately half-way between the wings and the tail, and corners were taken in reckless fashion, somewhat in the manner of certain American fire-engines which have rear-wheel steering.

A visit to the Tampier stand reveals the fact that this machine is provided with a small auxiliary engine with transmission to the main aeroplane wheels, which are provided with a differential, motor-car fashion. Some distance aft on the *fuselage* is another pair of wheels, mounted on a folding chassis structure, and so connected up to the rudder controls that they are steered by the same movement. The idea, of course, is that in case of a forced landing one can proceed by road under one's own power to the nearest place where repairs can be effected. The idea is sound, but naturally the extra engine and gear run away with a considerable proportion of the disposable load.

AERODYNAMICAL REPORT AND TESTS ON THE EGGLESTON AIR-CELL GIANT BIPLANE

THE test was carried out on October 12th and 13th, 1921, in the Curtiss 7-foot wind tunnel. The test was conducted by the Cox-Klemin Aircraft Corp., College Point, L. I., N. Y., Consulting, Designing and Constructing Engineers. The test followed standard methods and was carried out on a model of scale 1 to 72 at a wind speed of 30 miles per hour. The stabilizer was set at 3° to the wing chord. The tests included:

1. Lift, drift and pitching moment with the Eggleston Air cells in position.
2. Lift and drift with the Air cells replaced by Standard type streamline struts.

Stability

In the vector diagram, Fig. 1, the results of the pitching moment tests are shown. This vector diagram indicates that with the stabilizer of 3° to the wing chord, a very large degree of stability is secured. The vectors are well separated. Balance at cruising speed is secured if the load is arranged to bring the center of gravity three-tenths of the chord length aft of the landing edge. The position of the vectors is such that if the aeroplane tends to dive down, the aerodynamical forces will return it to its normal flight altitude.

If the aeroplane tends to stall or go up by the nose, the aerodynamical forces will return it to its normal flight altitude. The longitudinal stability of the plane may be therefore regarded as perfectly satisfactory.

Results of Test for Lift and Drag

The results of the test for lift and drag with and without the Air Cells are plotted in Fig. 2.

Those indicate that by replacing struts of standard form disposed in the manner of a Warren truss by the Eggleston Air Cell.

1. The maximum lift is increased from 6.25 to 7.07 pounds on the model, or approximately 13%.
2. The maximum lift/drag ratio of the plane, which is a very fair measure of the efficiency, is increased from 6.66 to 6.86, and the lift/drag at almost all angles is increased.
3. The general efficiency of the plane is high, particularly for a plane having two engine nacelles on either side, and short spans with a larger number of interplane supports.

Landing Speed

a—*With Eggleston Air Cells* (eight in number).

The maximum lift force on the model with the Eggleston Air Cells in position is 7.07 pounds. The landing speed is therefore given by the formula

$$\left(\frac{72x}{30}\right)^2 7.07 = 113{,}000$$

$$x = \frac{30}{72}\sqrt{\frac{113{,}000}{7.07}} = 52.7 \text{ M.P.H.}$$

This is not allowing for scale effect. With scale effect and skillful piloting, it may be expected that the ship should land not much over 45 miles per hour.

b—*Without Egglseton Air Cells.*

The maximum lift on the model without the Eggleston Air Cells is 6.3 pounds, so that the landing speed is 56 miles per hour. From the point of view of carrying a heavy load for a given wing area, the Eggleston Air Cells give a decided advantage.

The designer of the plane, Colonel Thomas L. Eggleston, states that a larger number of cells, namely 12, were originally to be used in this plane. It is not improbable that this would further increase the lift and diminish the landing speed.

Maximum Speed

The following calculations are based on the wind tunnel results corrected for scale affect.

Thrust at 90 M. P. H. = $\frac{6000 \times .78}{90} \times 375 = 19{,}500$ pounds, assuming propeller effieciency of 78%.

Lift-drag ratio of aeroplane at 90 M.P.H. is 5.1 x 1.14, taking the scale correction as 14%.

Drag of aeroplane at 90 M.P.H. = $\frac{113{,}000}{5.1 \times 1.14} = 19{,}400$ pounds, which is a trifle less than the thrust and shows that the full speed will be 90 M.P.H. with full load.

Climb

The best climbing speed is 63 M.P.H.; at this speed the lift drag ratio of the aeroplane (with scale correction of 14%) is 7.84. Therefore, the drag is 14,400, and the expenditure of $\frac{14{,}400 \times 63}{375} = 2420$ H.P. is required to overcome this drag.

The total power available is 3900 H.P., and the difference or excess power of 1480 H.P. which may be used in causing the aeroplane to climb. The rate of climb will be $\frac{1480 \times 33{,}000}{113{,}000} = 430$ ft. per minute. At 6500 feet elevation the rate of climb will be 100 ft. per minute.

Range

The maximum range is attained at an average speed of 65 M.P.H. The power required from the motors is

$$\frac{113{,}000 \times 65}{7.4 \times 375 \times .75} = 3530 \text{ H.P.}$$

The fuel consumption of the motors will be 1800 pounds per hour.

With a fuel load of 28,800 pounds, the range will be

$$\frac{28{,}800}{1800} \times 65 = 1040 \text{ miles.}$$

Useful Load and Pay Load

The preliminary weight estimate—which should be later checked by stress analysis and weight estimates—indicates a total useful load of 47,800 pounds. If a fuel load of 28,800 pounds is carried, a pay load of 19,000 pounds will be left over or the equivalent of 100 passengers with allowance for their baggage.

The Eggleston Air-Cell Giant Biplane

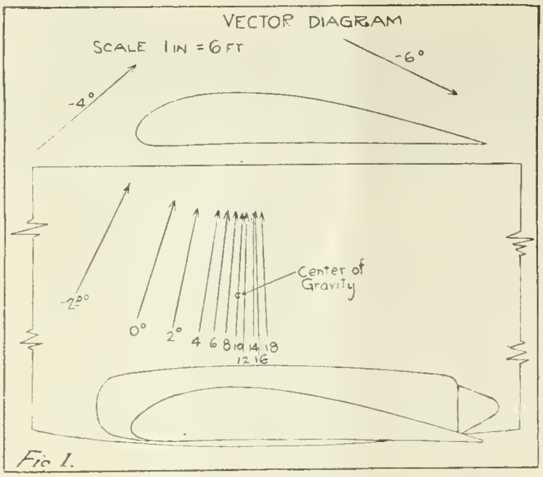

Fig 1.

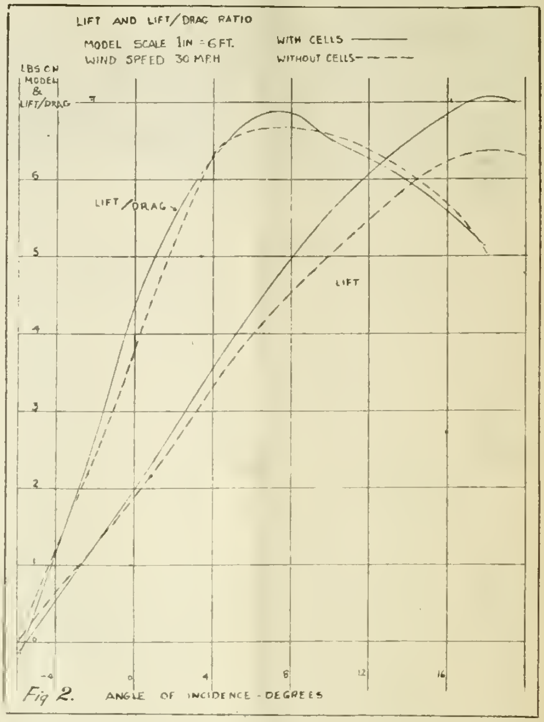

Fig 2.

General Conclusions

The general conclusions to be drawn from the test and general consideration of the plane are:

1—Perfect longitudinal stability is secured.

2—The Eggleston Air Cells improve the lift of a bi-plane.

3—The Eggleston Air Cells improve the efficiency of a biplane as compared with a Warren truss strutt bracing of the usual type.

4—With the employment of the Air Cells the number of interplane struts can be increased. This has the effect of decreasing the structural weight, since short spans thus become possible. With ordinary construction short unsupported spans increase the aerodynamic resistance. In the Eggleston Air Cell the extra aerodynamic resistance would be compensated for by the extra lift. There is, therefore, a possibility of keeping down wing weight for large spans.

5—If the structural weight estimated above can be met, the machine should have a maximum speed of 90 M.P.H., a climb of 430 ft. per minute, a landing speed of 45 M.P.H., a useful load of 47,800 pounds, and a cruising range of 1040 miles. The consideration of paragraph 4 would indicate that the structural weight of the wings can be kept down. The stability is good.

6—The fuel load allowed for gives the ship a cruising range of over 1000 miles, which is more than ample for any overland traveling; with a pay load of 19,000 pounds the

(*Concluded on page 326*)

GÖTTINGEN WIND TUNNEL FOR TESTING AIRCRAFT MODELS*

By DR. PRANDTL

(*Concluded from last week*)

In addition to the fact that it can turn on a circular track, a, the device has the further peculiarity that a part of it can float. Fig. 5 shows large pots, g, of which there are four. When water is poured into these pots, the so-called float frame, c, is supported by the floats. By pouring water into the pots, a lift of 0 to 2000 kg. may be generated, so that the heaviest objects can be floated. The purpose of the floats is to enable a horizontal motion in all directions, so that when we attach one or more scales to the object we can measure the forces without trouble from friction.

Fig. 5 shows, for example, an object held by stay wires with its axis vertical, ready to be subjected to the blast. Since it is all mounted on a turntable, any side may be turned toward the air current. Thus far provision has only been made for measurements of drag, but it is intended to provide also for lift measurements.

Fig. 6 is a diagram of the measuring device, the so-called 3-component balance, which has been chiefly used for measuring lift, drag and moment. It has been built on the plan of the very satisfactory device employed in the old plant, with some structural improvements, and also for greater forces. The aerofoils are usually hung bottom up, so that the lift stresses the wires instead of slackening them. In the contrary case, it may happen that the model, when it is not sufficiently weighted, is lifted and the wires are broken. By the above-indicated method, however, nothing can happen. When the model is not heavy enough to withstand a negative lift, a few additional weights are hung on span wires.

The model is suspended by three sets of wires: On the leading edge, by a set of three wires (a, b, c); in the rear by two wires (d, e); and also in front by a horizontal wire (f) against the air current. This suspension is statically determined, which is essential in order that all measurements may proceed smoothly. The static determination of any such weighing device is indispensable for a reliable multicomponent balance and is taken into consideration in the construction of all the balance joints. In the construction of the knife edges a number of new devices have been inevented.

The front system of wires hangs from a bridge, G_1, and the rear system from another bridge, G_2. The points of attachment to the bridges may be varied at will. These bridges hang, in turn, from balance arms, joined in pairs by shafts, to which the bridges are parallel. On the front end the balance arms have extensions (H_1, H_2) to which the rods A_1 and A_2 are attached. The scales for reading are intentionally omitted in the drawing. In reality, they are located about where the letters stand.

The drag wire, f, as in Fig. 4, transfers its force to two other wires, g and h, the latter being attached to the arm of the balance, W (Fig. 6).

It is perhaps unnecessary to state that the axes are not really supported by ordinary bearings, but on carefully constructed knife edges. The bearings are shown in the drawing only for the sake of simplicity and clearness. As in the old plant, the whole balance may be raised or lowered so as to change the attacking angle of the model. This is accomplished by means of the lever at the lower right-hand corner, which may be set at different heights.

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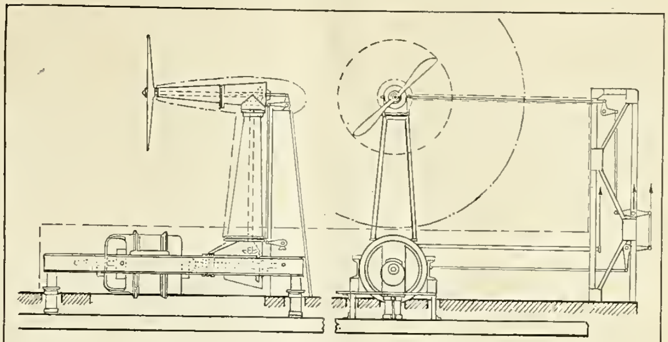
* Translated by the National Advisory Committee for Aeronautics.

Balance, W, gives the drag. Balances, A_1 and A_2, give the lift. Of course, all the balances must first read (or tared and brought to zero) without wind and then read with wind, when the difference in the two readings will give the force of the wind. Models of any desired weight may be used. Most of our models are made of plaster of Paris with a sheet-iron covering.

Fig. 7 shows a model rear view with its suspension wires, as soon from the collector, or blower end. We can recognize the front system of wires (a, b, c) and the rear system (d, e). The drag wire, f, does not show, but the vertical wire, h, does. The bottom wire, k, (Fig. 6) holds the whole system under tension by means of a weight. A small pressure gage is attached at the upper left and extends into the upper part of the tunel. The air current is so uniform that the gage does not need to be moved back and forth.



Longitudinal elevation

Front elevation

Below is float frame on which driving gear rests

Fig. 9. Propeller testing devise.

As shown in Fig. 2, the air is led from the collector to the blower by a cylinder, which was located here to enable the introduction of fresh air from out-doors through the basement through a second cylinder to the blower, in order to perform experiments (with radiators, for example) requiring a constant supply of fresh air. The latter cylinder has not yet been built.

Fig. 8 is a diagrammatic representation of a balance for measuring the six power components, namely, the three forces, lift, drag and drift, and the thre moments about the X, Y, Z, axes. This balance is practically finished. It has not yet been used, because we did not have the leisure during the war to make the final adjustments.

I will only try to give you a general idea of it here. The model is again suspended by six wires, but they are here attached to a rigid triangular board. The forces are resolved not by the model but by this board. The rods which transmit the six components are only indicated here by arrows. Rods 1 and 2 together give the lift and in their difference give the moment about the longitudinal axis. 3 and 4 give drag and the moment about the lateral axis. 5 and 6 give the lateral force and the moment about the vertical axis. With these rods there is connected still another system of levers, whereby the resolution of the forces and moments is effected and the center of the moments is located in the middle of the air current.

This complicated system of levers saves us all calculations and we immediately read on six scales, which in this case work automatically, the results, namely, the three forces and the three moments already calculated for us. Naturally, however, the allowances for the resistance of the wires themselves must be subsequently calculated. This was a difficult task which long delayed the completion of the balance.

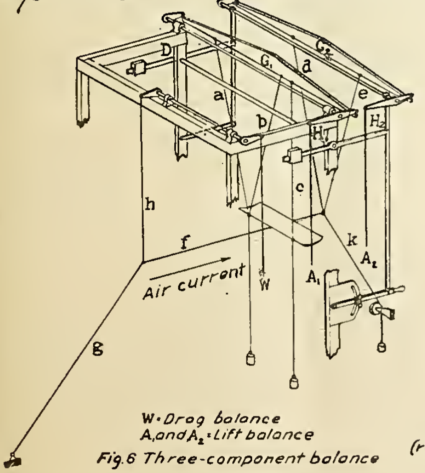
Fig. 9 shows the propeller testing device, which has also been constructed from a new point of view. All such devices must give the torque and thrust of the propeller. For the torque, in the ordinary devices, a coupling with a longitudinal motion is required. The couplings heretofore employed generate a moment in the structure which interferes with accurate weighing. They usually have ball bearings. The balls finally wear into the ball race and impair the accuracy of the measurement. The contact surfaces would frequently have to be reground or replaced. Here, instead of the longitudinally moving coupling, the whole mechanism is mounted on the float frame, which is shown at the bottom of the figure. Since the whole mechanism floats horizontally, we can now simply attach the thrust balance to the float frame and thus eliminate the longitudinal coupling. The torque is so measured that a balance indicates the couple at which the float is in neutral equilibrium.

The propeller is driven by a 50 h.p. electric motor by means of a bevel gear. All the driving parts are protected from the air current. Otherwise the latter would exert a force on the mechanism which would cause an error in the thrust reading. This propeller testing device has not yet been tried, because the machine works has had to remake the chrome-nickel-steel gear wheels several times on account of some defect in casting or workmanship. The propellers, which will have a diameter of one meter, will probably be driven at a speed as high as 5000 r.p.m. for the purpose of studying the influences of the compressibility of the air.

The new tunnel is designed for an air speed of 54 m/sec. and it will probably be possible to reach 60 m/sec., corresponding to an air efficiency of about 800 h.p. I believe that this plant (so far as indicated by the reports from enemy countries), at least until very recently, was the largest and most powerful of its kind. For the possibility of making it we must thank the generosity of our military administration.

I would not conclude any lecture without emphasizing the fact that I could not have carried the matter through without the devoted and intelligent assistance of my Göttingen fellow-workers. I wish to make special mention of Dr. Betz, who is

Figs 6-7-8



W·Drag balance
A_1 and A_2: Lift balance

Fig. 6 Three-component balance

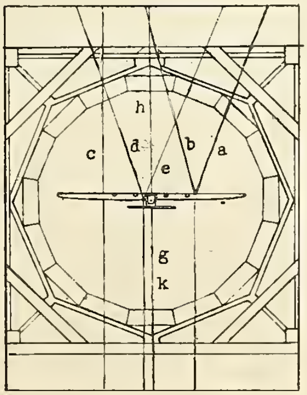
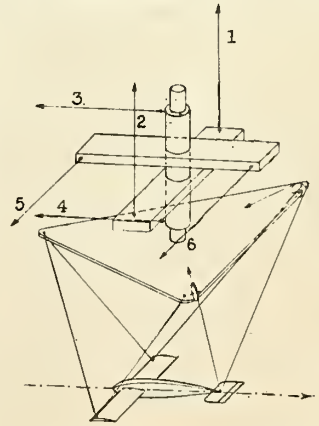


Fig. 7 Method of connecting model (rear view) with three-component balance, looking toward entrance cone.



Rods 1 & 2 give lift and rudder movment
Rods 3 & 4 give drag and elevator movment
Rods 5 & 6 give lateral force and movment

Fig 8 Six component balance

chiefly responsible for the wind tunnel, which he had previously tested in model form, and which, when set in operation, gave exactly the wind pressure we had calculated. I must also mention Dr. Wieselsberger for the construction of various fine apparatus. Much was worked out in common. For instance, we all helped on the pressure regulator. Dr. Betz also had a large share in constructing the balances. I must also make honorable mention of my constructing engineer from the beginning of my work. Dr. Thoma, who originated the ideas of building the tunnel of reinforced concrete and of giving it the vertical position. This was a great advance over our former method of construction. There are many others whose names I shall not mention, but all of whom I wish to thank.

Remarks

Professor Parseval inquired whether the balance would not lack sensitiveness on account of the four floats. He thought this would result from the great difference in lift, if a float went down on one side while the opposite float went up.

In this connection Dr. Prandtl claims that the center of gravity of the floating portion of the propeller testing device is quite elevated and that, by suitable water filling, the lateral metacenter may be brought as near as desired to the center of gravity. For this purpose the side floats are of comparatively small cross-section in the vertical direction. Hence, the fears of Prof. Parseval can be disregarded.

Engineer Gsell suggested that possibly the Eiffel tunnel might be more favorable in its power consumption than the Göttingen tunnel and that the loss of power at the exit of the former might be smaller than in the return current of the Göttingen tunnel; also that, in the Göttingen arrangement, power might be further conserved by gradually increasing the cross-section behind the experiment place into a "diffuser" before the beginning of the return current.

Prof. Prandtl answered that in fact the Eiffel tunnel appears to be from 5 to 10% more economical than the Göttingen tunnel. The cross-section of the Göttingen tunnel continually increases from the experiment place through the blower and return cylinder as far as the entrance cone. There is a loss of about 15% of the air pressure at each turn. There are, however, other more important grounds for this arrangement than that of a small improvement in economy. The main losses in the return tunnel come from its relatively small cross-section (about 10 sq. m.) at the first two bends, a compromise with the building cost, which would be correspondingly increased by lengthening the tunnel. Eiffel required no turns and saved some power thereby, but he has the disadvantage that his air current returns in all sorts of irregular ways through the hall to the intake place and thereby brings with it all sorts of eddies and cross currents. The fact that Eiffel, in addition to the honeycomb shown in his book, subsequently added another in the entrance cone, leads one to the conclusion that he previously found his air current too uneven. By the closed air current circuit we have the advantage of a very uniform current at the testing place, aside from the convenience of the open space for manipulating the apparatus by means of tracks and cranes, etc.

Professor Junkers stated that, in connection with the theoretically correct widening of the tunnel behind the entrance cone, he had experienced the difficulty that the aerofoil deflected the air stream so that it did not completely fill the widened tunnel, which impaired the effect of the widening. He considered the Göttingen arrangement better than the Eiffel.

Professor Karman agreed with the latter view and added that, if one had an empty airship hangar at his disposal, he might obtain good results even with the Eiffel arrangement.

Professor Prandtl, in his closing remarks, emphasized the fact that, with reference to the cost of building, which plays quite an important rôle, the maximum economy had been forgone. If he were to build again, he would stick to the same system, though improvements might be made in some of the details.

(*Continued from page* 324)

machine should be a most practical aeroplane of undoubted possibilities in commercial transportation.

Eggleston Model Test with Cells

Curtiss 7 ft. Tunnel
October 12th, 1921

i	D_{30}	D_0	D_{s30}	D_{50}	L_{30}	L_0
—6	1.268	.448	.646	.384	.341	.490
—4	1.185	.441	.636	.380	1.031	.490
—3	1.158	.439	.633	.337	1.34	.485
—2	1.143	.437	.633	.376	1.70	.485
—1	1.135	.434	.633	.375	2.042	.480
0	1.138	.431	.633	.373	2.43	.480
1	1.159	.429	.635	.370	2.72	.480
2	1.178	.425	.635	.367	3.16	.480
3	1.206	.422	.630	.362	3.52	.480
4	1.240	.419	.630	.358	3.90	.475
6	1.295	.414	.625	.354	4.61	.470
8	1.375	.408	.610	.350	5.33	.470
10	1.488	.401	.605	.340	5.81	.470
12	1.593	.393	.595	.330	6.35	.480
14	1.700	.387	.590	.324	6.65	.480
16	1.837	.380	.585	.317	7.10	.470
18	1.979	.373	.580	.310	7.30	.470
20	——	.367	.575	.304	7.10	.470

i	M_{30}	M_0	M_{s30}	M_{50}
—6	—1.60	—.32	1.26	—0.32
—4	—1.45		1.20	
—2	—1.33		1.20	
0	—1.21	—.32	1.32	—0.32
2	—1.04		1.30	
4	—0.60		1.30	
6	—0.33		1.35	
8	0.22		1.50	
10	0.69		1.52	
12	1.09		1.52	
14	1.72		1.53	
16	2.12	—.32	1.55	—0.32
18	2.80		1.56	

i	D_{30}	D_0	L_{30}	L_0
—6	1.286	.450	0.49	.50
—4	1.218	.445	1.15	.51
—2	1.190	.440	1.69	.50
0	1.177	.435	2.32	.50
2	1.180	.430	2.98	.49
4	1.205	.423	3.71	.49
8	1.325	.410	4.85	.48
12	1.490	.396	5.77	.48
16	1.706	.382	6.48	.47
18	1.855	.375	6.60	.47
20	2.080	.369	6.55	.47

Main Dimensions and Characteristics

Span of upper wing	255 ft.
Span of lower wing	223 ft.
Chord of both wings	25 ft.
Gap	25 ft.
Length over all	137 ft.
Total wing area	11,200 sq. ft.
Gross weight—loaded	113,000 lbs.
Total power (8—750 H.P. "W" motors)	6000 H.P.
Wing loading	10.1 lbs. per sq. ft.
Power loading	18.8 lbs. per H.P.

First Rough Weight Estimate

Structural weight—37.4%	42,200 lbs.
	113,000 lbs.
Power plant	23,000 lbs.
Useful load	47,800 lbs.

Wallace Kellett Co., Inc.

In order to facilitate operations in this country, W. Wallace Kellett, American representative for H. & M. Farman, has incorporated with the firm name of Wallace Kellett Co., Inc.

The company continues to represent the Farman Airplanes in the United States, and there will be no change in the Farman policy.

Offices remain as previously in the Widener Building, Philadelphia, Pa.

NAVAL *and* MILITARY AERONAUTICS

Airship Mooring Masts of the U. S. Air Service

After war operations ceased, the first system for anchoring non-rigid airships in the open air which proved at all practicable was developed in England. This system demonstrated the safe riding of the airship at anchor in reasonably high winds.

There has been developed by the U. S. Army Air Service a type of mooring mast which has proven very successful for the mooring of airships. The mast, as at present developed, consists of a structural steel tower held in a vertical position by steel cables. At the top of this mast is pivoted a cone shaped padded buffer, which is designed to fit the nose of the airship and distribute the pressure of such airship uniformly over the surface thereof. At the base of the tower or mast there is located a winch mechanism, operated by hand, designed to reel in a cable which is passed up the center of the mast over sheave wheels at the top and fastened, when the mast is in use, directly to the nose of the airship, which is suitably reinforced to withstand the strain. The mast has been designed with particular reference to portability, being made up in four sections, each 18 feet in length, making the total height of the mast 72 feet. An erecting derrick is provided, integral with the base of the mast, by means of which the mast may be installed in a minimum length of time. The entire mast may be disassembled into its 18-foot lengths, placed aboard standard Army trucks, and transported to its new site and there reassembled and erected in a minimum length of time, and with only such equipment as is contained in the mast itself, excepting a few small tools and old pieces of timber, etc., which would be required as dead-men for the securing of the guy cable.

Experiments with the mast conducted at Langley Field have been very successful and, while slight alterations are being made—as is always the case with entirely new designs—the basic idea and general dimensions of the mast, as they were originally designed and as they exist at present, will not be changed to any appreciable extent in future designs for this size of mast. This mast will properly handle ships from the smallest size, i.e., 35.000 cubic feet capacity, to ships as large as the Roma, which has a capacity of 1,200,000 cubic feet.

Arrangements are being made for the installation of auxiliary devices, such as direct piping, through the mast to the ship, of water, fuel, buoyant gas, compressed air, etc., and doubtless in the future development of this mast these auxiliary devices will receive more and more attention and the mast thereby refined considerably. Masts such as this, located at various points throughout the country, at municipal landing fields, Air Service flying fields, and the various strategic and protected sites, will provide means whereby airships, even to the smallest size, will be able to fly with entire security, traversing the entire country, and thereby establishing new means of rapid transportation.

The operation connected with the landing of an airship and attaching it to the mooring mast is a relatively simple matter, although great caution and skill on the part of the airship pilot are required to insure the security of the craft against damage. Upon approaching the mast, at an elevation of between one and two hundred feet, the mooring line is dropped and the end of it fastened to the end of the mooring mast cable which, as above mentioned, passes up through the center of the pivoted buffer cone over sheave wheels and down the center of the mast onto a storage drum actuated by a hand winch mechanism. The winch is now operated, drawing the ship's nose securely up into the padded cone, and the ship is secure and safe from any damage from ordinary weather conditions, flying from this position exactly as a weather vane does. As soon as the ship is secure, the hydrogen, fuel, air and water lines are connected to the ship, and she is prepared to either take off again on a continuation of her flight or to remain for weeks or months, requiring a minimum of attention upon the part of her crew. To perform the operation above outlined requires the services of but from five to twenty-five men, depending upon the nature of the air currents in the vicinity of the mast.

Upon approaching a mast preparatory to making a landing, an airship "weighs-off," i. e., the pilot discharges ballast or gas, depending upon whether the ship is "heavy" or "light," until the airship is in static equilibrium, or preferably a little "light," or, in other words, has a tendency to ascend upon the motors being idled and the dynamic effect of the controls neutralized. The ship is then directed toward the mast, approaching nose into the wind. Immediately the mooring cable is attached to the mast winch cable, the propellers are reversed, and a constant tension maintained upon the mooring cable until the ship is secure in the mast. In the absence of reversible propellers a few men are distributed upon the tail, handling guys to steady the ship into the wind and to prevent its yawing and riding up into the mast at too rapid a rate or by surges. While the airship is attached to the mast a single attendant, to maintain constant pressures in the gas compartments and the static equilibrium of the ship, is sufficient.

Test Flying at Night

On November 10th, 1st Lieutenant Alexander Pearson, Jr., 12th Squadron (Observation) stationed at Fort Bliss, Texas, took off at 9:30 P. M. for a night test flight. He flew a DH-4B plane, especially prepared for cross-country trips, having extra gas and oil tanks. Lieutenant Pearson was in the air 45 minutes, and without lights made a perfect landing on the aerodrome. He has on previous occasions made cross-country trips at night, finding his way over mountains and prairies and landing on the Fort Bliss aerodrome without trouble. On one occasion he and Sergeant Jungling were in Prescott, Arizona, doing work in the Grand Canyon, when late one afternoon orders were received to return to Nogales, Arizona, at once. The plane was made ready, and the trip was started at 7:30 P. M., 255 miles being covered in three hours' flying time and the landing at the aerodrome in Nogales being made at 10:30 P. M. The field at that station is a two-way field and very small. The landing was made without lights.

Anti-Air-Craft Target Practice Near San Pedro

Navy officers at San Pedro are attaching much significance to the arrival of Capt. H. V. Butler, commander of air squadrons, Pacific, and his senior aide, Lieut. Comdr. P. N. L. Bellinger, in command of a squadron of six F-5-L seaplanes. The tender *Aroostook* accompanied the planes on their trip from San Diego.

Fleet gunnery officers and the air squadron commanders are working on plans for joint practice of the battleship gunners and the planes, to be held next month. The plans include the towing by the planes of kite targets above the battleships at sea. Anti-aircraft gunners will attempt to hit the targets as they are being towed overhead at a speed of 60 miles an hour, it is said. This, however, is only one of the features of the plans now being worked out. Aerial photography, a branch of work which the Navy has been developing rapidly within the past few months, will play an important part in the maneuvers.

The program, officers say, is one of the most important ever worked out by the Navy in peace times, and emphasizes the new importance attached by naval authorities to the efficacy of planes in warfare.

Navy officers say that if the experiments prove successful it is probable that all future anti-aircraft gunnery practice aboard the ships on both the Atlantic and Pacific will be carried out with the aid of planes and towing targets.

Fort Sill Accident

Lawton, Okla.—Four army aviators, two officers and two privates were killed November 30.

The two aeroplanes in which they were performing combat duty drills collided while at an altitude of 2,000 feet, and crashed to earth near Fort Sill field.

The dead are Capt. Loomis, Lieut. A. T. Lanfall, Private Tubbard and Private B. A. Smith.

As the aeroplanes struck the earth, their gasoline tanks exploded, enveloping the wreckage in flames. Trucks and ambulances were rushed to the scene, but attendants were unable to reach the bodies of the men until they had been charred beyond recognition.

Army Forest Patrol

Army aviators flying in the forest patrol service discovered and reported 600 fires in California. Of the total number of fires discovered, 480 were reported by radio from the planes.

Fifteen radio stations co-operated with the air service in obtaining reports of fires. The airmen operated from March Field, Visalia, Mather Field and Corning. About 30 De Haviland planes were used in the forest patrol service.

FOREIGN NEWS

Portugal Loses Air Fleet

Lisbon.—The greater portion of the Portuguese air fleet was destroyed November 28 during a heavy windstorm which broke over the military aviation camp near here. Among the planes destroyed was one built for attempting a flight from Lisbon to Portuguese Guinea in Equatorial West Africa.

British Air Ministry

All sorts of rumors appear to be rife as to the future of the Air Ministry. It has been said that the Geddes Economy Committee is to recommend the abolition of the Ministry as a separate Department of State, but it has explained that, in common wtih all other Deparments, the Air Ministry was asked to answer a number of questions relating to details of its work and the expenditure involved, and also to justify both policy and the costs involved in carrying out that policy. It is stated by one morning London newspaper that "As far as can be ascertained" there is no definite suggestion at all on the lines that the Admiralty and the War Office shall again take charge of their own flying services. To emphasize this, the Prime Minister stated recently that the Government had not decided to do away with the Air Ministry as a separate Department. It may be observed that he did not say the Government had taken a definite decision *not* to scrap the Ministry.

As we are not in the inner councils of the Government, we cannot profess to know what is in their minds, but this we do know: that the constantly recurring rumors of the kind under discussion are doing no good at all either to the Royal Air Force or to the civil side of the Air Ministry's work. To enter upon a long discussion of the matter in its present stage would be quite unprofitable, so we shall leave it for the time being with the remark that the sooner the Government again announces in the most unambiguous terms that the Air Ministry is now as much a part of the machinery of the State as, let us say, the Home Office, and that it is here to stay, the better it be for all concerned.—[*Flight.*]

Kinshasa-Stanleyville (Belgian Congo) Air Mail Service

The British Postmaster-General announces that the Administration of the Belgian Congo has made arrangements whereby correspondence from this country for the Upper Congo may be forwarded by the aeroplane service which is now working between Kinshasa and Stanleyville (and intermediate points) in close connection with the arrival and departure of the Belgian packets from and for Europe.

The transit from Kinshasa to Stanleyville is due to be accomplished by air in three days, as against 14 days by river steamer; and correspondence for all districts along the Upper Congo River from Kwamouth as far as Lowa (but not for districts such as Katanga) should save up to a maximum of 11 days in time of transmission by the use of the air service.

Letter packets of all classes, registered and unregistered, but not parcels or insured packets, are admissible.

Any packet intended for onward transmission by the air service should bear the "Air Mail" label in the top left-hand corner, and be plainly marked by the sender immediately beneath it, "Par avion *viâ* Kinshasa." The packet should not be specially prepaid, but a fee of 3 francs per 20 grammes for air conveyance will be charged to the addressee on delivery.

Packets posted in time for transmission to the Congo by other than a Belgian steamship will probably not benefit by the use of the air service, and should not be marked for transmission by it.

"Nordstern" Becomes "Mediterranée"

By decree the name of the surrendered German dirigible "Nordstern" has been appropriately changed by the French to "Mediterranée," having regard to its employment next year on the commercial air service between Marseilles and Algiers.

Aerial Surveying in Australia

It is reported that an aerial survey of approximately 3,000 miles of country in Central Australia has been completed by Mr. Francis Birtles, who reached Melbourne on October 26.

Nungesser's Flying School

The famous French "Ace" Nungesser is reported to have opened a flying school at Orly. The school receives a State subsidy, and numerous pupils are said to have already enrolled. On a recent visit to the establishment M. Laurent Eynac, the French Under-Secretary of State for Air, is said to have expressed satisfaction at the manner in which the school is being run.

Canadian Air Mail Service

Sydney, Nova Scotia, November 24—The Newfoundland government aeroplane which will inaugurate a St. John's-Halifax mail service next week, is to make North Sydney a port of call for oil and petrol, according to instructions received by local officials of the Reid-Newfoundland Company. The machine was formerly used to scout for seals off the Newfoundland coast.

Aviation Meet on Lake Garda, Italy

The International Aviation Meet for the Gabriele d'Annunzio Cup took place on Lake Garda, September 16 to 25, 1921. Cash prizes to the amount of Lire 100,000 were awarded in addition to the d'Annunzio Cup and cups offered by the Ministry of Industry and Commerce.

The race for speed aeroplanes took place on September 18th over a total distance of 200 km. The course was very irregular, taking in various points around the lake, and was made four times, each lap being fifty km. Three Italian Navy Pursuit Seaplanes, M-7 type, entered, all of them completing the total distance. The three competitors started simultaneously, and this race was a very exciting one. Lieut. Conti of the Navy won first place in an M-7 pursuit seaplane, equipped with Isotta-Fraschini V-6, 250 h.p. motor; time 1 hour, 2′ 43″, average speed 191.336 km. per hour. This pilot won by making a daring turn at the last buoy, as he and Merola were practically tied during the entire race. Lieuts. Merola and Vuan of the Navy won second and third places respectively, the former's time being 1 hr, 2′ 43 3/5″, average speed 191.296 km., and the latter's time 1 hr, 5′ 29″, average speed 183.252 km. per hour. Merola made the fastest lap of the race, covering the 50 km. at an average speed of 195.355 km. per hour.

The race for seaplanes carrying a commercial load of 200 kg. took place on September 20th over a total distance of 200 km. This was over a different circuit from the race on September 18th. Each lap was 100 km. Five seaplanes entered this race and four completed the total distance, an M-9 being forced to withdraw after 150 km. Conforti of the Navy in an S-13 (I.F., V-6, 250 h.p.) seaplane, won first place, time 1 hour, 2′ 33 3/5″, average speed 191.815 km. per hour; Falaschi of the Navy in an S-13 seaplane was second, time 1 hour, 4′ 29 4/5″, average speed 186.095 km. per hour, and Passaleva of the Navy was third in an M-9 (Fiat A-12 bis, 280 h.p.), time 1 hour, 4′ 35 3/5″, average speed 185.777 km. per hour.

The final race for the cups was a handicap affair over a distance of 180 km. (5 laps of 36 km. each). Merola of the Navy, in an M-7, who was the last to start, as he was handicapped by 9 minutes 19 seconds, was the first to arrive, winning in 54′ 59 2/5″. Six competitors entered this race and all completed the required distance.

On other days of the Meet contests were held in acrobacy and for speed over a nautical mile course. A total of 15 different seaplanes competed in the various races. No new types, especially constructed for the races, were presented.

Two gliders (fast sea-sleds) with air screws, equipped with I.F. V-6, 250 h.p. engines, took part in special races held for them. The maximum speed developed by the faster of the two was about 85 km. per hour. Gliders of this type were used on Lake Garda during the war by the Italians for messenger service. The hostile lines crossed Lake Garda. According to a statement of the Chief of the Italian Naval Air Service, the Navy since the Armistice had carried out some experiments with gliders with the view to using them in off-shore defense, equipping them with machine guns, cannon, and possibly with torpedoes and large bombs. When equipped with large bombs, the pilot would jump with a life buoy before impact. All types that had been constructed in Italy were found absolutely unsatisfactory in the open sea on account of being too short to take the waves. For lack of available funds no new types along larger lines were built, and the experiments were discontinued. Two of the gliders were put into service by the Italian Navy along the Dalmatian Coast during the operations against d'Annunzio's forces, one of which was lost with the Naval Lieutenant-in-Charge. Their service was unsatisfactory.

Italian Aviation

A regular aerial service has been established by the Colonial Government of Lybia between the cities of Tripoli and Homs. The aeroplanes used belong to the Army and are part of the aerial force stationed in th Colony. Aeroplanes of the Caproni 450 type are used for transporting passengers and the S.V.A.10 type are used for transporting mail. The distance between these two cities is only 100 kilometers.

The safety of commercial aviation in Italy is illustrated by the official report of the activities of the civil aerial transportation company (Societa Anonima Imprese Aeree) covering the first year of its operation from June 1, 1920, to June 1, 1921. A total of 996.11 hours were flown over a distance of approximately 100,000 kilometers, 3,351 passengers being carried without accident. This line did not operate during the months of December and January. The greatest numbr of passengers (591) were carrid in July, 1920, followed by September with 520, and the lowest number carried during any month (138) was in March, 1921. Passenger traffic was heaviest during the summer months.

French Aeronautics

For some time it has been the intention of the Franco-Roumanian Aviation Co., who operate the Paris-Strasburg-Prague-Warsaw air line, to extend their line to Bucharest. On October 22 the first direct flight was made, and occupied 14 hours, including the stops at Strasburg, Prague and Budapest. By train the journey occupies about 63 hours, so that the saving effected is very considerable.

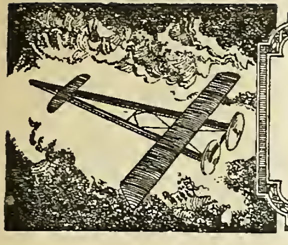
To replace the temporary resting places of the historical collection of objects relating to air navigation which have hitherto been deemed adequate in France for the purpose, a new "museum" is to be formally inaugurated on November 22nd at Chalais Meudon. "La France" hangar is to be utilized to this end, and the public will then have an opportunity of conveniently studying the many interesting "relics," etc., which have been collected relating to the past history of aviation.

Encouraged by the success attained during the German gliding competition in the Rhon hills this year, France has resolved to hold, next year, a somewhat similar competition. At present it is proposed to hold the competition from July 6 to 20, 1922. The competition is to be organized by the French Aerial Association, but before settling the rules and regulations it is proposed to call a "Congress" at the Grand Palais to discuss the possibilities of such a competition. The Congress is to take place on November 26 and 27 in one of the lecture halls of the Grand Palais, and the only condition imposed for admission to this Congress is that a communication should be made to the Congres d'Aviation sans Moteur, addressed to the General Secretary, M. Georges Houard, 17 Boulevard des Batignolles, Paris. The communications should bear on the following subjects: Theory or application of gliding flight; method of making the experiments; information relating to the Rhon experiments; rules and regulations of the French Competition in 1922, or suggestions concerning the competition, such as suitable place for holding it, rules and regulations, etc. Communications should not exceed 1,200 words and those accepted will be published in the French publication *Les Ailes.*

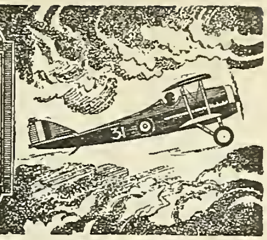
France is gradually turning the port of Antibes into an important air station, and it is hoped to establish air lines running to Corsica, Sardinia and Tunis, using Antibes as the French terminus. On October 18th a seaplane flew from Antibes to Corsica (Ajaccio) in 3 hours and 10 minutes, which is a very great saving of time as compared with the time taken by steamers.

Holland and Air Defence

In the 12-year scheme of naval defence for the Netherlands and Dutch East Indies, the Dutch Government has laid before Parliament aircraft figures in no mean degree. For the Indies, besides the various cruisers, destroyers, etc., provision is made for 72 reconnaissance 'planes, 18 bombers and 18 battle 'planes. For the Home Naval Air Force 35 reconnaissance and 15 battle 'planes are provided for.



ELEMENTARY AERONAUTICS *and* MODEL NOTES



Some Notes Regarding Soaring Birds

(Continued from last week's issue)

It is evident, however, that in order to gain height, it is necessary for the bird to resort to circling, and so far as the maneuver can be followed, its phases appear to be as follows:

The bird is assumed to be facing the wind; he lowers one wing (say the left) and turns to that side, the wind catching him under both wings, blowing him along with increased velocity. He continues to circle and is now gliding away from the wind, his velocity (relative to earth) now reaching a maximum. Continuing the circle, he is now moving across the wind, to which his back is presented, the outer wing being raised. During these three phases it appears that remarkably little, if any, height has been lost.

In the final phase of the circle, he faces the wind, bringing his wings into a horizontal position and increasing his angle of incidence so as to get as much lift as possible, even at the expense of drag, which is now obviously in action, the reduction of velocity with reference to the earth, being as apparent as the gain in height, and the bird only turning again when his forward velocity with reference to the earth has been almost expended in the production of lift.

The cheel is not the only bird possessing such powers—the vulture, saras, eagle, hawk and other birds also have them in a marked degree, but the cheel is very common (in India, where the observations were made by Capt. Wildeblood) and is a most efficient soarer. In the evening, after the wind drops, cheels flap heavily and alternately glide from point to point with a perceptible though small gliding angle.

Some Observations of Bird Performances

A cheel soaring very high, facing the wind, had the front edge of the outer primary feather inclined backwards at about 45 degrees. On the other hand, a vulture soaring at a lower level had his wing fully extended and the front edge of the outer primary feather almost in line with the front edge of the wing, which is at right angles to the line of flight.

A vulture, soaring overhead, moved his wing tip apparently with the object of depressing and retarding that wing. The movement is very noticeable in these large birds.

In the morning, when the breeze begins to rise, the cheels get up and flap and glide heavily until clear of the tree tops, when they circle and soar with an occasional flap or two. The cheels that come down for breakfast always have to flap to ascend.

Soaring in a very light breeze, a cheel which started at the level of the house tops, had risen at least two hundred feet without losing any headway against what slight breeze there was, and indeed making a little headway of perhaps fifty feet against it. Other cheels were soaring higher up at about 1,000 feet.

Behavior of Birds in a Windstorm

Some birds were observed flying in a windstorm while the gale was at its height. First was noticed a cheel soaring, head to wind. The wings were laid right back, the wing-tip feathers quite parallel to the body.

Then crows were seen in the same attitude and then pigeons, all soaring and flapping alternately. Even the doves and jays tried to do the same, though cautiously keeping near the ground and looking like beginners learning to skate. The wind velocity was terrific, and when a cheel or crow or pigeon turned and raised a wing to take the force of it, the bird shot away at a marvelous speed, turning again, however, quite easily, at will.

It is the observer's belief that, when in difficulties, the birds do make use of the lateral righting effect of feathers, inclined backwards, and having quills on their outer edges, an arrangement found to have so remarkable an effect in models of aeroplanes. The fact is not overlooked that the reclining backwards of the wing-tips may also be necessary for longitudinal stability or other reasons.

(To be continued)

Model Bodies Built of Papier Maché

A system has been worked out by Mr. Charles H. Lea, 538 Gridley Avenue, Akron, Ohio, for building fuselages of such models as the Verville-Packard of papier maché. A thirty-two-inch model, built from Aerial Age plans, but with this new type of body instead of the balsa wood which was suggested (and apparently rather difficult for some model builders to obtain) weighs ten ounces. It is believed that a reduction in the weight can be made in future models having the same type of body.

The papier maché method results in a fuselage strong enough to withstand the twist of the elastic motor, without using a separate motor-stick, and still the tail does not twist out of true.

Mr. Lea built a JN-4D2 model last summer. He is fortunate in having the assistance of a "chief test pilot," Lytle Tumer, who follows Mr. Lea's work with interest. Further inspiration is received from the builder's daughter and her little chum, who delight in the flights these models make. Mr. Lea is now planning to build a model of the Curtiss Navy racer.

The Requirements of Aeroplane Engine Design

The principal features desirable in the design of an aero engine are low weight per horsepower, reliability and smoothness of running, low fuel and oil consumption, compactness, simplicity of construction, ease of overhaul, reasonable initial cost and freedom from liability to fire.

The question of weight does not end with the engine itself. All the accessories must be included. In the case of the water-cooled engine the weight of the radiator and cooling water must be added. Separate special accessories, such as gasoline pressure pumps, carburetor and ignition controls, etc., must be considered. Another important factor in the weight problem is fuel economy. An engine designed to be of minimum weight per horsepower is usually less economical in oil and gasoline. For flights of short duration, the combined weight of engine and fuel would be less with the light engine. For prolonged flights, however, a heavier engine and a more economical one would actually be the lighter combination.

Reliability is a subject on which a great deal might be said. Probably nine-tenths of the accidents which occur are attributable to engine trouble. The commercial value of reliability is therefore obvious.

After the most skillful designer has done his utmost to bring the various parts to a standard of safety, tests only, either on the bench or in the air, can be relied upon to effect further improvements. Questions of wear, for instance, are chiefly matters of test. In any new engine certain parts will be found to wear out unduly in use. The designer must take this matter in hand, substituting more desirable materials for those originally used in these parts, improving their lubrication or increasing their dimensions as may be advisable. Over-loading is certain to occur sooner or late, and when an engine is sufficiently over-loaded something inevitably breaks. This reveals the engine's weakest spot and when the latter has been strengthened the next weakest fails upon over-loading. Thus by a process of constant experiment, with its resulting elimination, a chain is obtained in which all the links are more nearly equal in strength. The engine that has no weak point is really an ideal. The practical engine, however, is purposely designed with certain weaker points, the object being to localize to some particular replaceable member any damage which may occur owing to an excessive over-load; this acts in a way as a safety value for the rest of the structure. Although a very great deal depends on the original design, it is only by subsequent lavish experiment that the maximum reliability is reached.

A few of the most important factors which contribute to reliability of running as discussed by G. C. Baily, author of "The Complete Airman," will be given in a subsequent issue.

(To be continued)

A Flying Cadet's Bible

How many of us remember the trials of a Flying Cadet during the war before he was permitted to take the stick for the first time alone? Not the least of his troubles was encountered in ground school, where the habit of having him write the answers to questions on subjects he was supposed to have some knowledge on tap seemed developed to a most uncomfortable degree.

Aside from spelling, of which there were a large number of phonetic cases, the embryo airman sometimes got funny results from his attempts to express what he knew or thought he knew in answer to the questions of his instructors. The cadet who preferred "coatin the wires and cables of a plane with *paraphin* or grease to keep them soft and pliable" must have revised his opinion before completing his first hour in the air. He must also have found that a longeron was something more than "the line of stability drawn from the front to rear of an aeroplane." The ideas of some of his brothers-in-arms, as gathered during the life of the ground schools, were equally brilliant, for, according to them:—

1. "An aileron is a device on an aeroplane which by action of the air on itself when propelled through the air causes it to bear itself in the air."
2. "The aspect ratio is the ratio between two parts as they seem to be and as they are in reality."
3. "A side slip is falling away from the center of gravity by rotation about the fore and aft axis."
4. "Nose dive—a steep ascent nose down."
5. "Side slip—the manner of landing a plane when it catches on fire."
6. "Steel is tempered because then its structural resistance will be greater."
7. "Droop is the amount of wash-in we put in the left wing of a normal engine to overcome propeller torque."
8. "The heart of a tree is discarded because it is more 'naughty.'"
9. "Skidding is a thrill experienced when an attempt is made to turn in the air without making the proper degree of bank."
10. "In the daily inspection sighting is usually done by eye."
11. "The angle of incidence increases as the lift is changed from zero to 90 degrees."
12. "Disadvantages of soldering—weak but stronger than nothing."
13. "Soldering adds to friction, it is liable to be used for strength which it won't stand."
14. Some new ideas—"inherited stability; angle of indecence."
15. "Wires may be protected from moisture by covering them with something. We have galvanized wires and vanishing wires. The last method is the best."
16. "Galvanizing is preferred as a protection to wires as you use a much higher temperature when galvanizing and that tempers the steel wires."
17. "A factor of safety is a thorough inspection of a plane before flight and the renewal of any worn parts."
18. "Gap (of an aeroplane) is an airhole."
19. "Propeller race—the propeller turns so fast it races and exerts no thrust."
20. Propeller tested as to fitness for use—"the amount of air drawing ability is tested by standing in front with a piece of cloth."

H. L. McLean.

That Big Kick!

Out of control and spinning!
You've tried all the stuff you know,
Used opposite stick and rudder,
Tried working it fast—then tried it slow.
You've tried cutting down on the motor,
Hoped that she'd lift the nose,
Chanced "gunning it" out with throttle;
As the old earth begins to get close.

Then you were "set" for the big crash,
With hardly a hope for the "breaks."
Pulled the belt a little tighter;
Pushed the goggles from your face!
You've shut off the gas, you betcha!
And cut out the switches, too,
They may gather you up in a basket,
But cremation! not for you!

Now, with feet braced to the gas tank
And arms ready to cover your head,
You've drawn down "into the office,"
You've counted yourself out as dead.
You feel like a cheap second-rater,
Not fit for a place in the game!
And Oh! how that gang in the hangar
Forever will pan your name.

Wow! you can hardly believe it,
As the nose comes high in the sky,
For the controls have a hold
And she's soaring; and feelings like that don't lie.
So you hit her again with the motor
And redress as you take command,
Oh! of all the wonderful feelings!
There was never a kick half as grand.

A. A. C.

"Uh, Uh; Not Me!"

Co'se Ah ain't saying Ah won't do
Jes' what mah country wants me to,
But deys one job Ah fo'see
Ain't gwine to teach itself to me—
Uh, Uh; not me!

Dat's dis heah aihrplane stuff—no, boss,
Ah'll bah some othah kind ob cross
Lak drove a mule, er tote a gun,
But Ah ain't flirtin' wif de sun—
Uh, Uh; not me!

If Ah mus' do a loop-deloop
Let mine be 'roun' some chicken-coop;
It ain't gwine to be up whah the crows
Kin say Ah's trampin' on der toes—
Uh, Uh; not me!

It sho' look sweet, Ah don't deny,
To be a ozzin' 'roun' de sky,
But dat's fo' folks dat's in de mood;
Not fo' me, tho' co'se Ah's shrewd—
Uh, Uh; not me!

Down heah Ah firs' saw light of day,
Down heah am whah Ah's gwine to stay;
Folks, Ah don't keer to hab mah feet
Git too blame proud to walk de street—
Uh, Uh; not me!

—*Plane Talk.*

Two squads of New York's finest had been dispatched to the scene of a riot in a section of the "Big Town" particularly well known for its "Tough Micks." Upon the return of the policemen the man at the desk at headquarters wanted to know why no prisoners had been brought back.

"There were three reasons why," spoke up the sergeant in charge.

"What three reasons?" roared the man at the desk.

"Two Irishmen and a pile of bricks," was the answer.

The O. O. D.'s messenger was going through a certain dormitory the other night looking for the relief of the clothes line watch.

"What's that you have?" inquired a voice from the dark.

"A searchlight," replied the messenger.

"What are you looking for?"

"Morning," was the answer.

"Stick around and it'll dawn upon you," suggested the voice from the dark.

When a certain aviation machinst's mate was asked if he had taken a bath, he inquired if there was one missing.

SPECIAL CLASS EFFICIENCY RACE

OPEN TO PLANES CARRYING THREE OR LESS PERSONS

Course—Triangular, 30.7191 Miles.
5 Laps—153,595 Miles

CONTEST COMMITTEE REPORT
OMAHA, NEB., NOV. 5, 1921

Formula — $E = \frac{(W - T)\ S}{G}$

Place	PILOT	No.	PLANE	ENTRANT	TOTAL TIME		Average Speed M.P.H.	E	W Lbs.	T Lbs.	W-T Lbs.	S M.P.H	G Gals.	MOTOR		OIL	FUEL
					Min.	Sec.								Type	h.p.		
1	F. A. Donaldson	22	Oriole	Donaldson Bros.	132	24.4	69.60	3768	2828	2070	758	69.60	14	OX-5	90	Liberty Aero	Gasoline
2	H. D. Trinler	31	Longren	Longren Aircraft Co.	118	17.0	77.91	3437	1040.6	550	490.6	77.91	11.12	Lawrence 3 Cyl.	60	Liberty Aero	Gasoline
3	Buck Weaver	14	Laird Swallow	E. M. Laird Co.	122	38.0	75.14	2872	2195	1400	795	75.14	20.80	OX-5	90	Liberty Aero	Gasoline
4	W H. Beech	61	Laird Swallow	E. M. Laird Co.	139	00.6	66.29	2842	2058	1390	666	66.29	15.50	OX-5	90	Liberty Aero	Gasoline
*a*5	R. G. Bahl	20	Lark Monoplane	Harding, Zook & Bahl	158	58.0	57.97	2447	1257	650	607	57.97	14.38	Lawrence 3 Cyl.	60	Liberty Aero	Gasoline
6	R. M. Cochrane	65	Lincoln Standard	Nebraska Aircraft Co.	113	46.2	81.00	2370	2488	1660	828	81.00	28.30	Wright Hispano	150	Liberty Aero	Gasoline
7	Cyle Horschem	72	Laird Swallow	Cyle Herschem	130	29.8	70.62	2006	2054.5	1392	662.25	70.62	23.31	OX-5	90	Liberty Aero	Gasoline
*b*8	H. D. Robertson	30	Farman	Wallace Kellett	Forced	land'g			1042.2	550	492.2			Le Rhone	60	Castor	Gasoline
9	H. T. Lewis	S.V.A.	S.V.A.	Aero Import Corp.	2 Laps Motor	only. troubl	e		2216.	1683	533			S.P.A. H. Comp.	250	Castor	Gasoline 72% Benzol 28%

a—Two forced landings; broken fuel line—repaired; continued in race.

b—Forced landing near Loveland—ran out of fuel; damaged landing gear; unable to continue in race.

NOTE—The contestants in the above special class efficiency race competed during the Larsen Trophy Race over the same course for separate prizes and were eligible to compete for the Larsen Trophy and prizes provided such contestants should finish the entire 8 laps.

The above data is certified to be a true record of the result of the Special Efficiency Race held Nov. 5, 1921, as taken from original reports of judges, timers and other officials, made to the Contest Committee, and as accurately checked and accepted by such committee.

A. H. FETTERS, Chairman Technical Committee.
IRA A. RADER, Chairman Contest Committee.

New Aeroplane Supply Sale

Acetate Dope Guaranteed 55 Gal. Drum and 50 Gal. Bbls. $1.00 per Gal. No charge for containers. 5 Gal. lots $2.25 per Gal.

Spar Varnish, 5 Gal. cans, $2.25 per Gal.

Green Brown Wing Enamel, 5 Gal. cans, $1.50 per Gal.

TYCOS ALTIMETERS, register 20,000 feet radius, $15.00 each.

New Leather Aviation Helmets, $5.00 each, cost $18.00.

½" Brass Gasoline Stop Valves, $6.00 per Doz.

AC Spark Plugs Metrics $3.00 per Doz. $20.00 per hundred. $180.00 per M.

4" Barrel Turnbuckles $3.00 per Doz. $15.00 per hundred.

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Tufted Fabricoid covered cushions for above $1.25 each.

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NEW STANDARD AIRPLANE without motor $800 F. O. B. Houston. Floyd Logan, 712 W. Superior Ave., Cleveland, Ohio.

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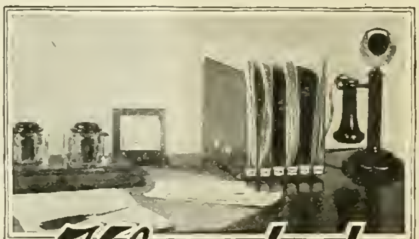

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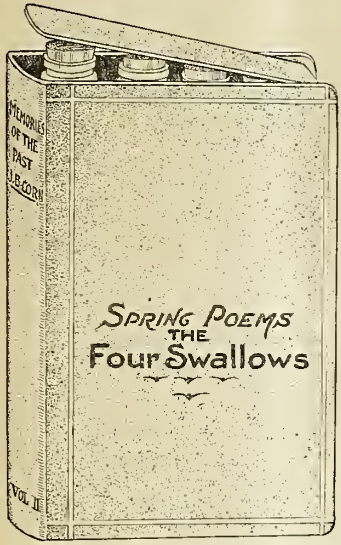

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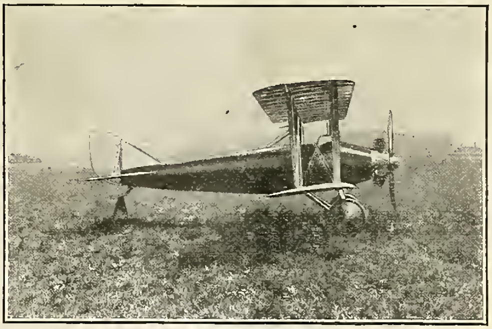

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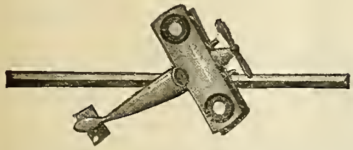

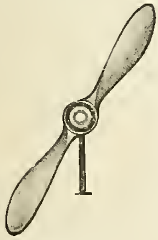

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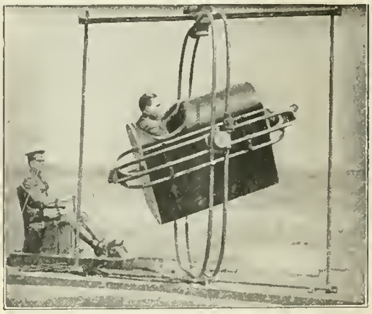

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Principles of Airplane Design

By George Marshall Denkinger, Research Aeronautical Engineer, Air Service, U. S. A., and Clarence Dean Hanscom, formerly Research Aeronautical Engineer, Air Service, U. S. A. (In preparation. Ready Spring, 1921.) Vol. I. Theoretical and Experimental Aerodynamics. Contents.—Aerodynamics. Wind Tunnels. Wings. Resistance. Vol. II. Applied Aerodynamics. Contents.—Estimation of Performance. Stress Analysis. Weight Estimation. Air Screws. Motors. Materials of Construction. [Wiley.]

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The Dynamics of the Airplane

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GOVERNMENT AID TO CIVIL AVIATION

WHEN Representative Hicks of New York introduced in the House recently his bill to establish a Bureau of Civil Aeronautics in the Department of Commerce he said that the European Governments were giving "their full co-operation and assistance" to civil aviation, and that it was now possible "to travel by air between all the principal cities of Europe at a cost which makes aviation a serious competitor of the railroads." The number of "air ports" built in Great Britain and on the Continent and planned for 1922 is a proof of progress in civil aeronautics that embarrasses Americans who are engaged in "promoting" companies to carry freight and passengers between the large cities "Where are your landing fields? How do you expect to accomplish anything until aviation is regulated by Federal legislation?" When these questions are put to them, they can only answer that they live in hope that the Hicks bill, or a similar measure, will soon be passed by Congress and be signed by the President.

Civil aviation is making headway in the United States, but slowly. At the end of November, the Navy Department made public an encouraging report of the trips or voyages made by the aeromarine-navy flying boats, which maintain a service connecting New York with Key West and Havana, New York with Albany by way of the Hudson, New York with New England ports, and Montreal along the Great Lakes to Chicago. While this service is experimental and as yet expensive, 1,044 passengers, 24,002 pounds of mail and 5,000 pounds of freight and baggage were carried 42,000 miles on six cruisers of the F-5-L type in the year ended Oct. 27, 1921. Six navy coast patrol boats carried 4,762 passengers 34,920 miles in the same period. No passenger or employé was injured. An S-2 air boat with 5 passengers flew completely round the Great Lakes, a distance of 7,491 miles. Planes of this service are often seen on the Hudson from the ferryboats. They are swift and powerful craft and move as steadily as launches on the surface of the river. In a letter accompanying the annual report of the National Advisory Committee for Aeronautics, President Harding says:

"Aviation is destined to make strides, and I believe that America, its birth-place, can and should be foremost in its development. I therefore urge upon Congress the advisability of giving heed to the recommendations of the committee, the first and foremost of which is that a bureau be established in the Department of Commerce for the regulation and development of air navigation."

The report of this committee, of which Dr. Charles D. Walcott, Director of the Smithsonian Institution, is chairman, declares that private enterprise would soon establish freight and passenger services in different parts of the country if landing fields, aerodromes and meteorological stations were made available by the Department of Commerce bureau which is proposed in the Hicks bill. "The first national airways," says the committee, "should be carefully planned to serve military as well as civil needs." It is also urged by the committee that the Government acquire the best helium-producing fields. America would then have, it says, a practical monopoly of helium, and no other nation could compete with it in operating airships for purposes of either war or commerce.

—*Editorial in N. Y. Times.*

The News of the Week

Harding Urges Bureau of Air Navigation

Washington. President Harding transmitted to Congress December 7 the annual report of the National Advisory Committee for Aeronautics with the recommendation that a bureau for the regulation and development of air-navigation be established in the Department of Commerce as proposed by the committee.

"I think there can be no doubt," the President stated in a message which accompanied the report, "that the development of aviation will become of great importance for the purposes of commerce as well as national defence. Aviation is destined to make great strides and I believe that America, its birthplace, can and should be foremost in its development.

"I therefore urge upon the Congress the advisability of giving heed to the recommendations of the committee, the first and most important of which is that a bureau be established in the Department of Commerce for the regulation and development of air navigation."

Oppose Aircraft Limit

Washington.—The American attitude toward military and commercial aviation appears to be that it should have unlimited development.

This attitude, it was learned December 7, was informally brought out in the first meeting of the conference sub-committee on aviation, in which the experts of the five powers took part. The instructions of the heads of the five delegations to the sub-committee were "to report on the number, character and use of aeroplanes." All the members of the sub-committee considered the instructions too brief and decided to ask the committee of five for more specific directions.

The general view expressed in the sub-committee was that as Secretary Hughes had said that the American plan for the limitation of naval armament did not provide for naval aircraft limitation, neither was it contemplated to limit army aeroplanes. That view was confirmed by the American members. It agreed with the French idea that as the production and use of commercial aircraft could not be limited, any more than any other means of transport or locomotion, nothing practicable could be done about military aeroplanes.

The aviation sub-committee will not meet again until directed to do so by the head of the delegations.

Aviators

To Cast Light 75 Miles as Guide to

The General Electric Company announced that between 8:30 and 9 o'clock December 8 it would begin experimenting with a 36-inch high intensity searchlight at Schenectady.

If the weather conditions are right, it is believed this searchlight will project a beam visible at a distance of seventy-five miles.

A 36-inch high intensity searchlight similar to those used in the navy stands stationary and plays directly on a mirror set at a 45-degree angle. From this angle the light is shot perpendicularly into the sky. By the movement of the mirror the beam acquires a rotary motion. The motion can be varied, and in this variation is found one of the practical applications of the beacon. The beam from a land lighthouse at Schenectady, for example, would have one movement and a light at Syracuse would have another movement. The aeroplane pilot, knowing the characteristic light movement of each station, would thus be able to pick his way in the dark.

The Union College Radio Club will cooperate with the engineers in making the demonstration, informing wireless amateurs throughout the State of the test and requesting them to report on the visibility of the beam from their points of observation.

Aircraft to Run on Sky Cable

London.—British aviation experts and capitalists have put their heads together on the proposition of perfectly safe airline travel, and the result is a proposed airship with a string to it. It is not on the kite principle, but what is proposed is that lines be built between large cities by which aeroplanes will be guided by cables about 400 feet in the air so that they will be sure to reach their destination and not be lost in the fog, as often happens nowadays.

The proposed airline has many advantages over unguided travel, it is declared, and is not so expensive as to be prohibitive. The "cars" could make 150 miles an hour with perfect safety, and this saving in time over rail travel would be an inducement to travelers. What is proposed is a heavy cable stretched between towers 400 feet in height. The "car" would run along this cable, being connected beneath the "car" so that it would provide a guide and keep the plane from shooting off at angles in heavy winds and also would prevent the pilot losing his way at night.

The plan is declared by the aviation experts to be perfectly feasible. The capitalists say the money can be provided as soon as it is seen that the scheme will draw a proper amount of traffic. In fact, it is declared that despite the cost of the towers and the cables it will be cheaper to build and maintain than a surface railroad of the same length. The plane will not rest upon the cable, but will be kept in the air by the wing spread and the momentum. The cable simply will keep it on the line. Also, it is possible, with the cable plan, to operate the line by electricity. The power being furnished through the cables from the huge power plant at some convenient point along the line.

The great speed proposed has its advantages, inasmuch as it would mean a great saving of time. A trip to Liverpool and return could be made in less than one-third the time now consumed, which would mean that a business man could go from London to Liverpool by way of the airline, attend to business that would consume several hours, then return to London in less time than is now required for the train trip one way. In America such lines would be of even greater value than anywhere in Europe. From New York to Chicago trains require 20 hours or more for the trip. Over the air line a business man could leave New York early in the morning, reach Chicago in six hours, attend to his urgent business and be back home in the evening for dinner and a visit to the opera.

This scheme is not at all visionary, the experts say, and they declare that plans are already under way that will result in the construction of such a line in this country as will be a model for similar lines in other parts of the world. The development of the aeroplane has been such in the past few years that they declare no one can yet see the limit of its possibilities. Air travel is so common in Europe at the present time that it is no longer considered a novelty. The chief thought now is toward greater safety.

Annual Banquet of the Aero Club of America

The fourteenth annual banquet of the Aero Club of America will be held this year in the grand ballroom of the Hotel Commodore, New York City, at 7:30 Monday evening, January 9, 1922.

The courtesy of the membership of the Aero Club of America has been extended by the Board of Governors for this day to the members of the Society of Automotive Engineers, Automobile Club of America, Automobile Club of New York, Motor Boat Club of America and the New York Yacht Club.

Members of the various clubs and their guests will be seated at the same and adjoining tables.

List of speakers and their subjects will be announced later.

The Banquet Committee consists of Mr. Benedict Crowell, Chairman; Messrs. Jas. A. Blair, Jr., Howard E. Coffin, Maurice Cleary, Cole J. Younger, Augustus Post, Arthur Scholle and Caleb Bragg.

Pulitzer Trophy Race

The Pulitzer Trophy Race next year will be held under the same conditions and over the course originally scheduled for Detroit in 1921.

Detroit Aerial Derby

The Detroit Aerial Derby will include all competitors for Aviation Country Club of Detroit Trophy, Liberty Engine Builders Trophy, Class Race Prizes and Invitation Races. The conditions for this event will be announced shortly.

Detroit News Aerial Mail Trophy

The Detroit News Aerial Mail Trophy for Multi-motored Aeroplanes, will be held under the same conditions and over the course originally scheduled for Detroit in 1921.

Speed Trials

Preparations will be made for Speed Trials over a kilometer course.

Bennett Balloon Race to Start From Geneva

Bern.—Geneva as the starting point for the 1922 Gordon Bennett balloon race has been practically decided upon by the Swiss Aero Club.

Bern has renounced her claim to the distinction, recognizing that the surroundings are not conducive to favorable takeoffs. Zurich had the start in the race of 1910.

Bomber Up 26,500 Feet

Dayton.—The feat of Lieutenant Leigh Wade, a test pilot at McCook Aviation Field, in reaching an altitude of 26,500 feet in a United States Army Martin bombing plane Dec. 8 was acclaimed by the officers at the field as demonstrating the practicability of daylight bombing. Henceforth, they said, limited speed of the heavy planes and inability to reach high altitudes had led to the belief that only night bombing expeditions could be successfully conducted.

Following Lieutenant Wade's flight, during which he carried an observer, officers voiced the belief that he had established a world's record for a multi-motored plane with two occupants.

At an altitude of 26,500 feet, Lieutenant Wade said, his gasoline feed lines froze and he was forced to descend. A minimum temperature of 34.6 degrees below zero was registered. The flight occupied four hours.

Aeroplane Exports Decrease

In the November 28th issue of Commerce Reports, published by the U. S. Department of Commerce, it is stated that in spite of the fact that the commercial value of aeroplanes as a means of communication is realized more and more, and that air service all over the world is constantly expanding, exports of aeroplanes manufactured in the United States fell off considerably during October. A comparison of aeroplane shipments, excluding parts, for October, 1921, with those of September, shows a decrease of 88 per cent in number and 74 per cent in value; a comparison of the October, 1921, figures with those for October, 1920, gives evidence of a still greater decrease—90 per cent in number and 95 per cent in value.

Civil Aviation in Canada

The Air Board, Ottawa, Canada, gives a summary of civil aviation certificates and licenses issued, cancelled, renewed and still in force during 1920 and 1921.

During the year 1920, 10 applications were denied; 403 new certificates or licenses issued; 27 lapsed or were suspended; 23 were renewed; in force on December 31, 1920, 375.

During the period January 1, 1921, to October 31, 1921, no applications were denied; 244 new certificates or licenses were issued; 261 lapsed or were suspended; 117 were renewed, making the grand total of certificates or licenses in force on October 31, 1921, of 475.

New Aviation Bill Offered

Washington.—Legislation to carry the recommendations of President Harding with respect to creation of a bureau of civil aviation was introduced in the Senate Dec. 12 by Senator Wadsworth, Republican, of New York. The proposed bureau would be established in the Department of Commerce and be supervised by a commissioner, the object being to "encourage, foster and regulate" civil aviation.

The Wadsworth bill, together with a similar bill presented in the House by Representative Hicks, Republican, of New York, results from conferences between the representatives of the Aero Club of America, the aircraft industry and the heads of the army and navy air services, the weather bureau and the national advisory committee for aeronautics.

Four Engineering Bodies Honor Marshal Foch

When Marshal Foch reached New York Dec. 12 he was acclaimed as a fellow engineer by the organized engineers of America, who, at a ceremony in the Engineering Societies Building, 29 West Thirty-ninth street, conferred upon him the unique distinction of honorary membership in the four national engineering societies.

The event is without precedent in American engineering, no other man ever having been elected to honorary membership in all four of the founder societies, consisting of the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers. The presentation of the certificate of honorary membership was made in the auditorium of the Engineers Societies Building.

New Wireless Control Also Lands Planes

London.—In addition to controlling the flight of an aeroplane by wireless, attempts are being made in France to devise mechanism to enable a plane not only to ascend pilotless but also to land without any hand on the controls.

Devices in course of perfection show wonderful ingenuity. In one case a machine without a pilot, its engine having been started, runs across the aerodrome, causing to revolve at a rapidly increasing pace a small two bladed fan or screw between the wings. The fan as soon as it turns a certain number of revolutions actuates mechanism which places the control surfaces of the machine in the right position for ascent, its manœuvres while aloft being controlled by wireless.

When the time comes for landing the tap of a ground wireless key has the effect of unrolling beneath the aeroplane a length of wire with a weight at the end. This weight, touching ground while the machine is at some little height, switches off the engine and causes the rear surfaces of the plane to set themselves in such a position that the landing wheels of the machine make a smoth contact with the ground.

French wireless control of aeroplanes has achieved already a notable triumph. A large machine was taken up by its pilot, who left the controls and allowed the machine to be manœvred for more than an hour by wireless operators in a land station far below. At a given signal the pilot resumed control and landed.

Rockaway Naval Station Meets Another Obstacle

The Parks and Playgrounds Association, of which George Gordon Battle is President, added its protest to that of the Committee on Non-Partisan Facts against giving the Jacob Riis Park at Rockaway Point to the Government for a naval aviation station. The association contends that before the transfer is made the navy should prove that it is justified as an imperative necessity for proper national defense.

"The opportunity of the people of the City of New York for recreation and healthful exercise is already circumscribed by the limited amount of park area which is available for that purpose," says the association.

"The occupation of any part of this park by the navy as a naval air station may interfere with the utility of the rest of the park for the proper purposes of pleasure and recreation. The naval air station will be a source of constant danger to those who may use the area in its immediate vicinity as a pleasure ground. Even if the danger be regarded as more apparent than real the apprehension which is inspired in people generally by the presence of airships, with an occasional accident or mishap, is of itself sufficient to diminish, if not entirely destroy, the attractiveness of this seaside park as a place of resort.

"Our position is that since there are other available sites for the navy's purposes, since the Jacob A. Riis Park is not indispensable for the national defense, and since it is our duty to oppose any encroachment upon park space, we shall resist the navy's effort to obtain the Jacob A. Riis Park for aviation purposes."

CALENDAR OF COMING EVENTS
under saction of
AERO CLUB OF AMERICA

Annual Banquet Aero Club of America
Hotel Commodore, New York City,
7:30 Monday Evening, January 9, 1922
For members (who are entitled to bring guests) of
Aero Club of America, and affiliated Aero Clubs
Society of Automotive Engineers
Automobile Club of America
Automobile Club of New York
Motor Boat Club of America
New York Yacht Club
Tickets: $8.00

April 30th (1 or 2 days)
Spring Show and Opening Meet
Place: Curtiss Field, Mineola, L. I., N. Y.
Conducted by: Curtiss Airplane & Motor Corporation, Garden City, L. I.

September 4th (about) 1-day meet for
Detroit Aerial Water Derby
Curtiss Marine Trophy
Class Race Prizes
Invitation Races
Speed Trophy
Place: Detroit River and Lake St. Clair.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

September 15th (about) 3-day meet
Pulitzer Trophy
Detroit Aerial Derby
for Aviation Country Club of Detroit Trophy and Liberty Engine Builders' Trophy and Class Race Prizes
Invitation Races
Detroit News Aerial Mail Trophy
for Multimotored Aeroplanes Speed Trials
Place: Mt. Clemons Field, Detroit, Mich.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

August 15th (about)
In Preparation by the Aero Club of America
American Elimination Trials, if Necessary for La Coupe Deutsch de la Meurthe (Race to be held in France about October 1st. Place: Mitchel Field, Mineola, L. I., N. Y.

September 30th
First Annual Interservice Championship Meet
Open to the personnel of
The U. S. Army, Navy and Marine Corps Air Service
Championships in Single Seater Fighting Bombing Reconnaissance Races Photography Races Formation Flying, Etc.
Location: Mitchel Field, L. I., N. Y.

August 1st (about)
Foreign Events
Coupe Jacques Schneider
Contest for Flying Boats and Seaplanes
Place: Italy (probably Venice).
Conducted by: Aero Club d'Itali, 24 Via Tor de'Specchi, Rome.
American entries received by the Aero Club of America.

October 1st (about)
Coupe Henry Deutsche De La Meurthe Race for Aeroplanes
Place: France.
Conducted by: Aero Club of France, 35 Rue François-1, Paris.
American entries received by the Aero Club of America.

The AIRCRAFT TRADE REVIEW

Kimball Heads A. S. M. E.

The election of Dean Dexter S. Kimball of the College of Engineering of Cornell University as president of the American Society of Mechanical Engineers was announced December 7.

Dean Kimball took office at once, succeeding Edwin S. Carman of Cleveland, and will serve for one year. He heads an organization of 15,000 members with active professional divisions and local sections in every principal industrial centre in the country.

Other officers elected were: Vice-Presidents, Colonel Edward A. Deeds of Dayton, Ohio; Robert Sibley of San Francisco and Louis E. Strothman of Milwaukee; managers, Sherwood F. Jeter of Hartford, Conn.; Horace P. Liversidge of Philadelphia, Hollis P. Porter of Tulsa, Okla., and Walter S. Finlay of New York; treasurer, William H. Wiley of New York; secretary, Calvin W. Rice of New York.

With the election of Dean Kimball the society set in motion two important movements, one looking to world engineering unity and the other to remedy what the engineers say are deplorable conditions in the United States Patent Office, menacing American industry and invention. In the campaign for better Patent Office conditions the society will work with other national engineering organizations.

Vickers to Be Constructed in France

The Grand Express Aeriennes Company of Paris, have purchased the license to construct the Vickers Vimy Commercial in France, for commercial transportation.

S. A. E. Tachometer Standard Revised

The Aeronautic Division of the Society of Automotive Engineers Standards Committee has recommended that certain revisions be made in the present S. A. E. Standard for Tachometer Drive. These revisions are recommended because experience has indicated that the present standard dimensions for the shaft connection on the engine end are not of suitable proportions to insure freedom from trouble. This is especially true in the operation of the centrifugal type of tachometer which turns faster than indicated speed. Breakage has therefore resulted through the use of the present dimensions, even though special alloy steels have been used for the shaft.

The Aeronautic Division recommends an increase in the diameter of the driving shaft from 0.152 to 0.187 in. and an increase in the diameter of the hole for the driving shaft from 0.161 to 0.191 in. These recommendations will be acted upon at the next meeting of the Standards Committee on Jan. 10 in the Engineering Societies Building, New York City.

Sims Interests Ford in Making Aeroplanes

Detroit.—Henry Ford's next creation will be the "air flivver," according to reliable rumors in circulation in Detroit. Intimations that the Ford Company intended to manufacture aeroplanes for commercial use, in circulation recently, became more positive as a result of the conference of Ford, Rear Admiral Sims and Thomas Edison at Dearborn on Dec. 7.

Rear Admiral Sims during his visit to Detroit emphasized strongly his belief that the aeroplane was the most important thing ever developed by man. He is said to have communicated his ideas to Ford, who requested that the Admiral remain in Detroit until Edison and Ford returned from Muscle Shoals.

W. B. Mayo, chief engineer of Ford enterprises, who is known as an advocate of aerial transportation, was also present at the conference.

Air Service Bids

Engine Parts—Procurement Branch, Air Service, Tempo Bldg. No. 6, Washington.—Bids are wanted until 2:30 P. M., December 27, circular ASA-11, for furnishing large quantities of miscellaneous spare parts for Liberty engines.

Remodeling Oil Pumps—Procurement Branch, Air Service, Tempo Bldg. No. 6, Washington.—Bids are wanted until 2:30 P. M., December 29, for remodeling oil pumps for Liberty engines.

Bomb Hoists and Control Handles—Air Service, Procurement Branch, Tempo. Bldg. No. 6, Washington.—Bids are wanted until 2:30 P. M., December 17, for 20 universal bomb hoists and 400 bomb rack control handles.

Elastic Cords—Air Service, Procurement Branch, Tempo. Bldg. No. 6, Washington.—Bids are wanted until 2:30 P. M., December 28, circular ASA-19, for 2,000 ft. ½-in. shock absorber rubber, 5,000 ft. do, 5,000 ft. do, 3,000 ft. do, 1,000 ft. ⅝-in. shock absorber rubber and 2,000 ft. do.

UNITED STATES POST OFFICE DEPARTMENT—AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, October 1921

DIVISION	Gasoline	Grease and Oil	Repairs and Accessories	Miscellaneous	Motorcycles. Trucks	Rent, Light, Fuel, Power, Telephone and Water	Office Force and Watchmen	Warehouse	Pilots	Mechanics and Helpers	Testing & Experimental Work at College Park	Radio	Departmental Overhead Charge	TOTAL	SERVICE AND UNIT COST				
															Gallons of Gasoline	Total Time Run Hr., Min.	Total Miles Run	Cost per Hour	Cost per Mile
EASTERN New York-Chicago	$5,305.59	$970.88	$3,862.01	$4,707.87	$1,617.77	$794.50	$3,291.41	$1,667.40	$4,659.85	$5,828.93	$215.50	$3,029.70	$812.03	$36,763.44	14,785	495 24	45,205	$74 16	$0.8
CENTRAL Chicago-Rock Springs	5,004.96	1,441.02	[a] $10,349.39	4,278.34	1,173.09	450.65	3,481.39	2,414.85	6,201.85	7,424.12	312.10	4,387.85	1,176.03	48,095,64	18,330	750 33	65,655	64 08	.
WESTERN Rock Springs-San Francisco	3,547.48	653.63	[b] 11,669.92	1,938.14	1,040.48	287.44	3,992.61	1,667.40	4,651.88	3,840.20	215.51	3,029.71	812.03	37,346.43	12,864	533 35	48,111	69 70	.
Totals and Averages...	$13,858.03	$3,065.53	$25,881.32	$10,924.35	$3,831.34	$1,532.59	$10,765.41	$5,749.65	$15,513.58	$17,093.25	$743.11	$10,447.26	$2,800.09	$122,205.51	46,469	1,779 32	158,971	$68.58	$0

[a] Includes new motor in Plane No. 71 and wings and tail section on Plane No. 260.

[b] Includes new motors in Planes No. 126 and No. 149.

TOTAL Operating Cost	$122,205.51
Permanent Improvements..	6,501.09
GRAND TOTAL	$128,706.60

COST PER MILE

Division	Overhead	Flying	Maintenance
Eastern	$0 22	$0.24	$0.35
Central	17	.19	37
Western	19	.18	40
Entire Service	$0 20	$0.20	$0 37

Overhead consists of: Departmental overhead; office force and watchmen; motorcycles a trucks; rent, light, fuel, power, telephone and water; radio; testing and experiment work.

Maintenance consists of: Miscellaneous; mechanics and helpers; repairs and accessories, a warehouse.

Flying consists of: Gas; grease and oil; and pilots.

E. H. SHAUGHNESSY, Second Assistant Postmaster General.

CORRECTION OF THE AEROFOIL CHARACTERISTICS FOR ASPECT RATIO

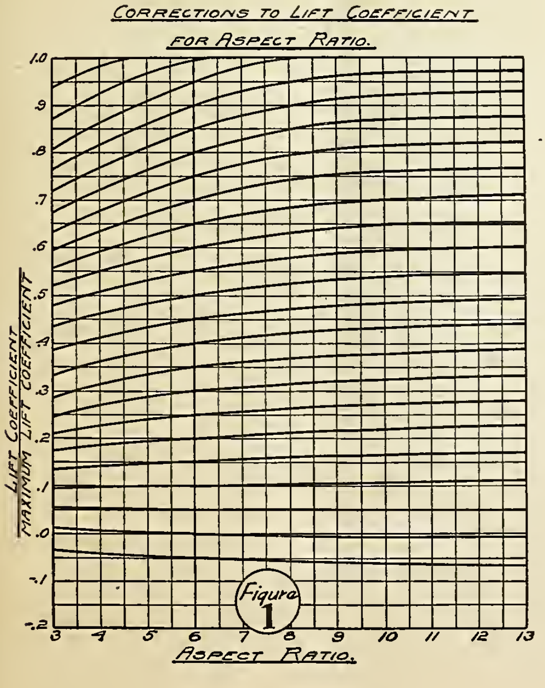
By B. V. KORVIN-KROUKOVSKY

M. Sc., Aeromarine Plane and Motor Co.

ASPECT ratio of the airplane wings varies from 4, in case of some monoplanes, to 13 in case of large flying boats. The models of aerofoils are usually tested in wind tunnel with the aspect ratio of 6. It is evident that, for the purpose of prediction of the performance of a new machine, the results of the wind tunnel test must be corrected for the aspect ratio, as well as for other conditions different from the conditions of the test. The correction for aspect ratio is commonly made by means of empirical curves given in the British Advisory Committee for Aeronautics Rep. & Memo. No. 450, which curves were derived from the results of experiments made by the National Physical Laboratory in 1912. Since the publication of the R. & M. No. 450, however, some additional information on the effect of aspect ratio becomes available, and it is the purpose of the present article to show that by the combination of this additional information with the empirical curves mentioned very good results may be secured.

The curves for correction of the lift coefficient for aspect ratio, shown on Fig. 1, are reproduced from the R. & M. No. 450. In order to use the curves it is necessary first to find the ratio of the lift coefficient to the Maximum Lift Coefficient of the wing under consideration, then start from the corresponding point on the vertical line of the aspect ratio of 6 and follow along the nearest curve up to the aspect ratio of the wing under consideration; at this point new value of the ratio Lc/Lc-max. can be read off the curve. Max. lift coefficient, multiplied by this ratio, will give corrected value of the lift coefficient. The ratios of the lift coefficients to max. lift coefficient were used in construction of these curves in preference to the lift coefficients themselves, because this renders the curves equally convenient for the use in case of wings with different values of the max. lift coefficient, and because it was assumed that the max. lift coefficient does not vary appreciably with the aspect ratio. The investigation of the pressure distribution along model wings, made later by the National Physical Laboratory, showed that the lift of the wing is approximately proportional to the (Aspect Ratio—0.42), (see R. & M. No. 575). On the basis of this information, correction of the max. lift coefficient for the aspect ratio takes the form:

$$\text{Lc-max. (corrected)} = \text{Lc-max. (original)} \times \frac{(\text{A.R.} - 0.42)}{\text{A.R.}} \times \frac{6}{5.58}$$



Corrected values of all lift coefficients can be obtained by multiplying the max. lift coefficient thus found by the ratio Lc/Lc-max., corrected by means of the curves of Fig. 1.

In order to demonstrate the practical application of the correction, data of the test of R. A. F.-6a aerofoil (from R. & M. No. 148) are given in the Table I and are corrected to the aspect ratio of 13. Last column of the table contains the results of the actual test of the aerofoil of the aspect ratio of 13 (from R. & M. No. 439). Comparison of the last two columns of the Table I shows how high is the accuracy of the correction.

TABLE I

Angle of Attack	Lc Original	Ratio Lc/Lc—Max.		Lc Corrected	Lc A.R.=13 Observed
		Original	Corrected		
— 2	.010	.017	.006	.003	.005
0	.102	.175	.187	.114	.117
+ 2	.207	.355	.390	.237	.248
4	.284	.487	.532	.324	.322
6	.355	.607	.660	.402	.406
8	.424	.726	.794	.483	.487
10	.489	.838	.913	.555	.563
12	.551	.942	1.000	.608	.610
14	.584	1.000	....	....	....

$$\textit{Lc-max.}_{13} = \frac{13 - .42}{13} \times \frac{6}{5.58} \times \text{Lc-max.}_{6} =$$

1.04 Lc-max. $_6$

$$\text{Lc-max.}_{13} = 1.04 \times .584 = 6.08$$

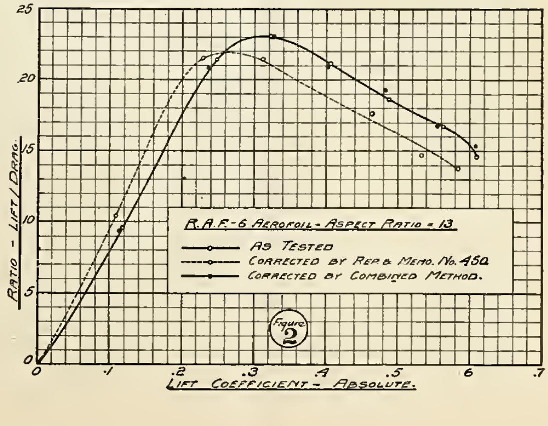
Dr. Prandtl showed that the drag of an aerofoil can be considered as composed of two parts: Drag due to the section proper, independent of the plan form of the aerofoil, and "Induced Drag," which depends on the plan form of the aerofoil and is parabolic function of the lift. The value of the induced drag coefficient (Dc-i.), if expressed as British or American absolute drag coefficient, takes the form:

$$\text{Dc-i} = \text{K Lc}^2, \qquad \text{where K} = \frac{2}{\pi} \times \frac{\text{A}}{\text{S}^2}$$

where A = wing area, and S = wing span. In case of the wing of rectangular plan form S^2/A is equal to the aspect ratio. It appears, however, that in practice the above formula gives exaggerated corrections, and that better results are obtained by applying to it the empirical coefficient of 0.8. Then, for the purpose of correction of the drag coefficient for aspect ratio, we write the value of K as:

$$\text{K} = \frac{1.6}{\pi \times (\text{Aspect Ratio})}$$

In Table II are given drag coefficients for the R. A. F.-6a aerofoil of aspect ratio of 6, and correction is made to the aspect ratio of 13. The procedure of the correction is as follows: In the first column of the table are given the angles of attack, and in the second column, corresponding drag coefficients for the aspect ratio of 6. The angles of attack are needed merely as reference numbers in order to take the



corresponding lift coefficients from the Table I, which are necessary for the calculation of the Induced Drag Coefficients. In third column induced drag coefficients are computed for the aspect ratio of 6, using *uncorrected* values of the lift coefficient. In fourth column are given differences between numbers in second and third columns, *i.e.,* section drag coefficients. In fifth column induced drag coefficients for the aspect ratio of 13 are computed, using *corrected* values of the lift coefficient. In sixth column corrected drag coefficients are given, which are obtained by mere addition of the numbers in fourth and fifth columns. In seventh column the values of the drag coefficient are given, as observed on the test of the aerofoil of aspect ratio of 6. It may be noted that agreement between calculated and observed values is very good.

TABLE II

For Aspect Ratio of 6, K = 1.6/3.14 ×6 = .0850.
For Aspect Ratio of 6, K = 1.6/3.14 × 6 = .0850.

1	2	3	4	5	6.	7
Angle of Attack	Dc A.R.=6	Dc-i. A.R.=6	Dc-s (Section)	Dc-i. A.R.=13	Dc Corrected A.R.=13	Dc Observed A.R.=13
— 2	.0140	.0000	.0140	.0000	.0140	.0163
0	.0126	.0009	.0117	.0005	.0122	.0124
+ 2	.0128	.0036	.0092	.0022	.0114	.0112
4	.0170	.0069	.0101	.0041	.0142	.0140
6	.0235	.0107	.0128	.0063	.0191	.0193
8	.0313	.0153	.0160	.0091	.0251	.0262
10	.0413	.0203	.0210	.0121	.0331	.0333
12	.0506	.0257	.0249	.0145	.0394	.0415
14	.0619	.0290	.0329	.....	.....	.....

TABLE III

Angle of Attack	Lc	Dc	Ratio L/D	
			Corrected	Observed
— 2	.003	.0140	.21	.31
0	.114	.0122	9.35	9.50
+ 2	.237	.0114	20.8	21.4
4	.324	.0142	23.0	23.0
6	.402	.0191	21.0	21.1
8	.483	.0251	19.25	18.6
10	.555	.0331	16.75	16.7
12	.608	.0394	15.4	14.6

In the Table III corrected values of the lift and drag coefficients are summarized and the ratios of the lift to drag are computed for all angles. As before, the values of L/D as obtained from the test are placed in the last column of the table. Data from the last two columns are plotted for comparison on Fig. 2 against corresponding lift coefficients. It may be noted that although the values of L/D for any one angle of attack do not agree exactly, they are displaced in such a way that when plotted against corresponding lift coefficients, they form practically identical curve. The results of the correction by means of the data from R. & M. No. 450 alone are plotted on the same diagram and dotted line is drawn through the points thus obtained, allowing convenient comparison of this older method with combined method described above.

PERFORMANCE TEST OF SPAD 13 EQUIPPED WITH 220 H. P. WRIGHT ENGINE

Prepared by Engineering Division, Air Service, McCook Field, Dayton

Official Performance Test—Summary of Results

Aeroplane: Spad 13.
No.: P-154.
Type: I.
Engine: 220 H. P. Hispano-Suiza.
Propeller: S. C. No. 109778.
Equipped as: Single-seater pursuit.
Weight empty (including water): 1,464 pounds.
Armament and Equipment: 185 pounds.
Crew: 180 pounds.
Gasoline: 177 pounds.
Oil: 30 pounds.
Weight loaded: 2,036 pounds.
Weight per square foot: 9.5 pounds.
Weight per horsepower: 9.16 pounds.
Fineness: 104.

Standard altitude in feet	Climb				Speed		
	Time in	Rev. per min.	Rate ft./min.	Flow gal./min.	Miles per hr.	Rev per hr.	Flow gal./hr.
0	0	2'040	1,200	.....	131.5	2,300	.....
6,500	6.5	2,040	810	.....	128	2,260	.....
10,000	11.5	2,040	600	.....	124.5	2,225	.....
15,000	23'	2,030	300	.....	117	2,140	.....
20,000	.....	.....	.....	.....	.....	.....	.....
25,000	.....	.....	.....	.....	.....	.....	.....
*a*18,400	42.5	2,020	100	.....	105	2,060	.....
*b*20,000	.....	2,010	..0	.....	89.5	2,010	.....

a Service ceiling; *b* Absolute ceiling.

Endurance, full throttle at 10,000 feet (including climb), 2 hours 30 minutes.

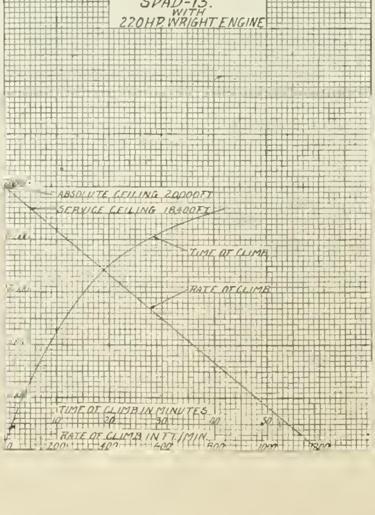
Minimum speed at sea level (lowest throttle), 65 m. p. h.

Landing speed, 59 m. p. h.

Pilot's Observations on Spad 13

This aeroplane taxies very easily even in a high wind, and has no tendency to turn in either direction on the ground. It should be taxied with the control stick held forward to lessen the weight on the tail skid. The tail skid is set too straight and has broken on two different occasions while taxying over rough ground.

It is a difficult aeroplane to take-off because of the tendency to swing to the right immediately upon opening the throttle, and if given left rudder too fast will swing to the left. In order to make a good fast take-off it is necessary to push the control stick slightly forward to raise the tail from the ground. This feature is noticeable after having flown other pursuit aeroplanes of approximately the same power.



In flight the aeroplane is very steady, but requires a good deal of left rudder, as the engine torque is very pronounced. It is tail heavy flying level, and also climbing with wide-open throttle, but this tail heaviness is not so pronounced above 15,000 feet.

The cockpit is very roomy, although the rudder bar is set too close to the pilot and tires the legs in a long flight. It is a very warm and comfortable aeroplane to fly altitude or on cold days, but not on warm days or low flying with wide-open throttle, such as contact patrol.

The aeroplane maneuvers easily and shows no tendency to spin in very tight banks. The visibility is good to either side and above the top wing, but is blind straight ahead and below.

The constant noise of the geared engine is very annoying and at altitudes above 16,000 feet the engine operates badly. The engine is very susceptible to temperature changes in a glide and cools quickly, so that the pilot must control his shutters constantly in changing altitude.

The engine is not very accessible for maintenance, and the installation could be improved.

This aeroplane lands easily, shows no tendency to turn on the ground, and stops short owing to the heavy tail. Even when landed tail high or on a rough field it does not show any tendency to nose over.

Description of Aeroplane
Dimensions

Over-all span: 26 feet 3¾ inches.
Over-all length: 20 feet 4 inches.
Over-all height: 7 feet 6½ inches.
Height at hub of propeller above ground:

In flying position: No propeller or engine in aeroplane.

Wings

Wing curve: Unknown.
Sweep back: None.
Dihedral degrees: None.
Stagger: 1¼°.
Gap: 3 feet 10½ inches.
Total area, including ailerons: 227 square feet.

Upper Wing

(Including center section.)

Span: 26 feet 3¾ inches.
Chord: 4 feet 7⅛ inches.
Area, with ailerons: Unknown.
Incidence, degrees: Upper, 1¼°; lower, 1°.
Span (from center section to wing tip): 13 feet 2 inches.

Lower Wing

Span: 26 feet 3¾ inches.
Chord: 4 feet 7⅛ inches.
Incidence, degrees: 1°.
Span (from fuselage to wing tip): 11 feet 2¼ inches.

Ailerons or Flaps

Number: 2.
Arrangement: On upper wing only.
Upper wing:
  Length: 7 feet 3½ inches.
  Chord: 1 foot 7½ inches.
Lower wing:
  Length: None.
  Chord: None.
Distance from longitudinal axis of aeroplane to center of aileron: 9 feet 4¼ inches.

Stabilizer

Span (maximum): 10 feet 2 inches.
Chord (maximum): 2 feet 3⅛ inches.

Elevator

Span (maximum): 10 feet 2 inches.
Distance from leading edge of elevator
Chord (maximum): 1 foot 8¾ inches.
to center of gravity of aeroplane: Center of gravity unknown.

Rudder

Height (maximum): 3 feet 10⅝ inches.
Chord (maximum): 2 feet 2 inches.

Fin

Height: 2 feet ⅞ inch.
Width (maximum): 3 feet 11¼ inches.

Fuselage

Maximum cross-section height: 2 feet 2 inches.
Maximum cross-section depth: 3 feet 2 inches.
Distance of maximum section from leading edge, lower plane: 3 feet 10 inches.

Landing Gear

Number of wheels: 2.
Tread: 4 feet 10¾ inches.
Shock-absorbing system: Rubber cord.
Braking device: Tail skid.
Wheels ahead of center of gravity: Unknown.

Distribution of Weights

[By pounds.]

Weight empty (with water): 1,464.
Armament and equipment: 185.
Crew: 180.
Gasoline: 177.
Oil: 30.
Weight loaded: 2,036.
Weight on front wheels (tail skid on ground): 1,714.
Weight on tail skid (tail skid on ground): 322.

Weight on front wheels (flying position): 1,826.

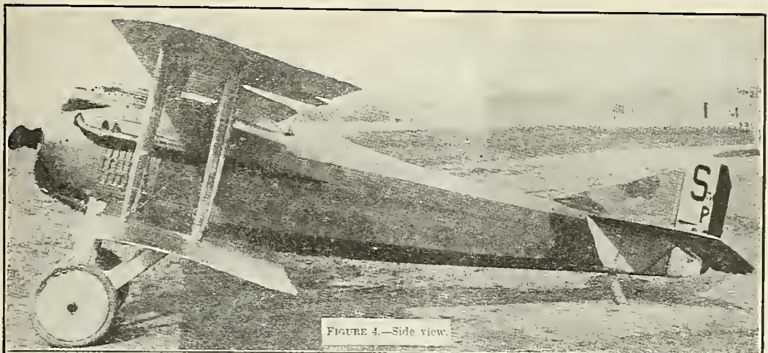


FIGURE 4.—Side view.

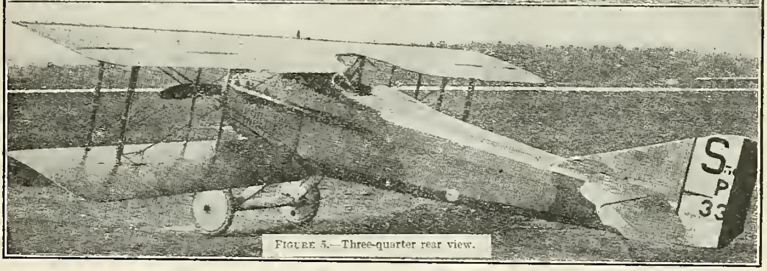


FIGURE 5.—Three-quarter rear view.

Weight on tail skid (flying position): 210.
Center of gravity (distance from wheels in flying position): 1 foot 5 inches.
Provision for special equipment not carried during test.

Description of Power Plant

Engine

Make: Wright.
Factory No.: 119908.
A. S. No.: 94888.
Type: Eight-cylinder "V"; 90°.
No. in plane: 1.
Location: Nose of fuselage.
Rated h. p.: 220.
Rated r. p. m.: 2,000.
Bore: 4.72 inches.
Stroke: 5.12 inches.
Compression ratio: 4.8 to 1.
Weight dry: 503.
Gas consumption: 0.472 pounds per h. p. hr.

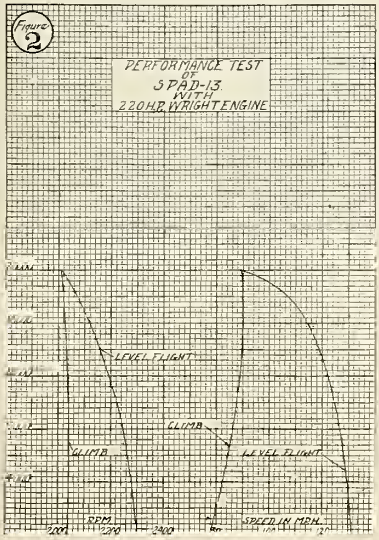


Figure 2

Oil consumption: 0.02002 pounds per h. p. hr.

Ignition

Battery or magneto: Magneto.
Make: Magicienne.
Number: 2.
Advance, degrees: 26° and 27°.
Gap interrupter: 0.020.
Plugs, make: A. C.
Type: Metal body porcelain insulator.

Carburetors

Make: Claudel.
Type: Barrel butterfly.
Number: 1.

Radiators

Make: French.
Type: Ribbon.
Number: 1.
Position: Nose of fuselage.
Depth: 3⅞ inches.
Length: 2 feet 4⅝ inches.
Width: 2 feet 2⅝ inches.
Temperature adjustment: Vane shutters.

Exhaust Pipes

Description: Individual stacks on each cylinder merging into manifolds which extend to rear of cockpit.

Lubrication

Capacity oil tank: 4.5 gallons.
Type pump: Eccentric vane.
Wet or dry sump: Dry sump.

Fuel System

Number of tanks: Two; 1 main; 1 gravity.
Location: Main, rear of engine in fuselage entire system.
Description of fuel-supply system: Air-pressure system.

Motor Control

Description: Rod and lever.

Propeller

Make: Engineering division.
Number of blades: 2.
Diameter: 8 feet 2 3/16 inches.
Pitch: 7.26 feet.
Tips: Terne plate and linen.
Remarks: Made of walnut, left hand.

PROGRAM AND CONDITIONS OF THE DETROIT AERIAL WATER DERBY, INCLUDING THE CURTISS MARINE TROPHY; CLASS AND INVITATION EVENTS TO BE HELD IN DETROIT THE FIRST WEEK IN SEPTEMBER, 1922

Curtiss Marine Trophy

New Deed of Gift

1. The trophy shall be perpetual and competed for annually by seaplanes and flying boats.
2. The contest shall be in the nature of a race either around a closed circuit or from point to point. The rules governing the race each year to be drawn up by the Contest Committee of the Aero Club of America.
3. The trophy shall be awarded each year to the Aero Club represented by the pilot of the winning machine, and this Club shall be entitled to the possession of the trophy until one month prior to the next succeeding contest, at which time the trophy shall be returned to the Aero Club of America. The Contest Committee of the Aero Club of America, with the consent of the Board of Governors, has the privilege of conducting each annual contest for the Curtiss Marine trophy, or of assigning this privilege, under sanction, to any other club or organization.

Conditions of Contest

1. *Free-for-All for Flying Boats and Seaplanes,* having

   (a) Factor of safety (monoplanes: six) as loaded for start of race; (biplanes: four) as loaded for start of race.

   (b) Air speed greater than 70 miles per hour, as loaded for start of race.

   (c) Visibility and maneuverability (water and air) which in opinion of Contest Committee, Detroit Aviation Society, is not a menace to the other contestants or spectators.

2. *Distance, Approximately 160 Miles.* Eight times around a closed course of 20 miles.

3. *Rules of the Race.*

   (a) Upon receiving the gateway signal for the start, pilots shall hold a straight course and not cross or attempt to cross in front of the planes on either side.

   (b) From a standing start contestants will fly around the first four laps of the course, but during the last four laps will be obliged to alight on the water and while running along the surface of the water enter into and pass through, in the proper direction, the water controls which shall be designated by moored markers on both sides. After passing out of a water control, contestants must take the air and fly at least one-half the distance to the next water control.

   (*Note.—There will be two or more water controls on each lap and at least one will round a turning mark.*)

   (c) While within the markers bounding the water controls, the contestants must maintain constant contact between the water and fixed surfaces of the principal flotation gear (wing or tail pontoons; or water rudder, or any other adjustable, movable or flexible attachment is not sufficient contact with the water, under this rule).

   (d) A plane overtaken, both planes being in the air, must hold its altitude and a true course, in order that it may not in any way impede or interfere with the faster overtaking plane.

   (e) A plane overtaking a slower plane, both planes being in the air, shall never pass or attempt to pass between that plane and any pylon or object used to mark a turning point.

   (f) Within the water controls, both planes being on the water, the overtaking plane must pass to the left, and all mechanicians of competing planes must look to the rear and warn pilots of an overtaking plane. Pilots of overtaken planes must keep to the right and give the faster overtaking plane room to pass on the left.

   (g) The finishing line must be crossed in flight—not on the water—and after crossing the finishing line, all planes shall continue on their course until they have attained sufficient altitude to enable them to turn and land without crossing the course or finishing line.

   (h) No contestant shall start before he receives the getaway signal.

   (i) Pilots shall pass outside all turning points and in plain view of officials stationed at each point, and at an altitude of not more than 250 feet.

   Fouling a Mark. "Any competitor who has failed to turn a stake properly may validly continue on the circuit provided he makes a complete turn of the said stake and then continues his trip in the same direction." F. A. I. Rules, Art. 115.

   (j) No contestant shall be permitted to "dope" the fuel with picric acid, ether, or similar highly explosive liquids. Benzol and similar anti-knock fuels may be used.

4. *Start.*

   (a) The starting signal will be given at ——— A. M. Planes to be in their allotted places at ——— A. M. Pilots' meeting for the final instructions to be announced later.

   (b) Position at start. Planes competing for class and invitation prizes in addition to Curtiss Marine Trophy will be sent away together in a class, the faster classes starting before slower. Competitors for Curtiss Marine Trophy only will be sent away together after the classes.

   (c) Method of starting. Contestants will be lined up along the shore in shallow water for the start. The starter will assign an assistant starter to each plane who shall raise the signal flags for its pilot, as follows: The starting signal (for motors only) a red flag will be raised by the chief starter at —— A. M. When the motor of each plane is running, the assistant starter assigned to that plane will raise the red starting flag. When all assistants have raised the red starting flags, but not later than —— A. M., the starter will raise, in addition to the red starting flag, the white warning flag, which signifies that the getaway signal will be given in ten seconds; each second will be counted by lowering the red flag, the getaway signal being the lowering of both red and white flags. If any contestant has difficulty in starting his motor, his assistant starter will not raise the red starting flag, but, when the chief starter raises the white warning flag, will raise a blue flag, which is a request for a deferred start. Deferred starts shall be granted without penalty, except that no plane will be started after a delay of two hours.

5. *The Finish.*

   The finishing time will be taken when each plane flies across the finishing line between the marks defining this line, after having completed the full course, 160 miles.

6. *The Winner.*

   Of each first place shall be the pilot which has completed the full course in the shortest elapsed time, and of each second place, the second best time, etc., provided the pilot is not disqualified. The Curtiss Marine Trophy will be awarded to the club represented by the pilot and the prize money paid to the entrant of the winning seaplane or flying boat. Agreements between pilots and entrants as to their portional share of the prize money will be upheld up the Contest Committee, who will pay the prize money in accordance with agreements in writing between pilots and entrants, presented to the Contest Committee prior to the race or within 24 hours after the finish of the race.

7. *Qualifications.*

   No seaplane or flying boat may take part in the contest unless it is piloted or commanded by a pilot, who must be on board and who must be furnished with a license issued by the Contest Committee of the Aero Club of America (F. A. I. Rules, Art. 67). Every person furnished with Pilot's certificate of F. A. I. may obtain license issued optionally by Contest Committee, Aero Club of America (F. A. I. Rules, Art. 70). A license will be valid until the 31st December of the current year. The Contest Committee, Aero Club of America, may, upon the occasion of any competition or test, issue temporary license as pilot for this one test only to any person whose qualifications it considers sufficient (F. A. I. Rules, Art. A-28).

8. *Disqualifications.*

   Any contestant breaking the above rules of the race, or subsequent ones which may be sent out in writing, shall, upon recommendation of the judges, be disqualified.

   "Every person organizing or taking part in a sporting event of whatsoever nature, is supposed:

   (1) "To know the present regulations (F. A. I. Rules) thoroughly.

   (2) "To agree to submit without restriction to the consequences that result therefrom" (F. A. I. Rules, Art. 7).

9. *Protests.*

   No protest shall be considered unless presented in writing to the Contest Committee of Detroit Aviation Society within twenty-four hours after the finish of the race (F. A. I. Rules, Arts. 78, 79, 80). (Appeals. See F. A. I. Rules, Art. 178-179.)

10. *Numbers.*

Each plane shall have the number assigned to it by the Contest Committee painted on the bottom surface of lower wing and on each side of the fuselage, clear of the wing, in characters as large as possible. It shall have no numbering over twelve inches in height.

11. *Advertisements.*

"Competitors are forbidden to display on their apparatus or material any commercial advertisement except the trade-mark of the constructor of the apparatus" (F. A. I. Rules, Art. 89).

(*Note.—The word plane as used in these rules means flying boats or seaplanes.*)

Additional Prizes

1. The (to be announced later) prizes for greatest air speed will be awarded to the contestant who, during the Curtiss Marine Trophy race, completes laps 2, 3 and 4 in the shortest total elapsed time. (The first lap is not included because of the standing start.)

2. Additional prizes will be awarded for Class or Invitation races to be announced by the Contest Committee of the Detroit Aviation Society after entries have closed.

(a) *Class Races.* Four or more planes of the same design and equipped with the same motor shall constitute a class.

Class Rule. Planes eligible for class races are those constructed under the same design and general specifications and not altered to materially change these specifications, nor to prevent the interchange of any corresponding part or parts of any two planes.

Furthermore, should any interchange of corresponding part or parts be directed under this rule, the plane must remain the same after the interchange from the standpoint of design and operation.

Exceptions. Stream lining which does not alter the structure of the part or parts stream-lined.

Motors eligible for class races are determined by the above rule and these exceptions:

(1) Stream lining which does not alter the structure of the part or parts stream-lined.

(2) Motors may be equipped with any make or design of propeller, ignition, spark plugs, carburetor, including intake manifold, exhaust manifold, gasoline and oil systems.

(b) *Invitation Races.* The Contest Committee of the Detroit Aviation Society may invite any of the entrants to compete for a special prize.

Entries

Free entries close July 31, 1922.

25% penalty entries close August 7, 1922.

50% penalty entries close September 13, 1922.

The entry fee, $100, will be refunded if the contestant is in his allotted place ready to start in the contest, provided the entry is received before July 31st. Entries received after July 31st but prior to August 7th will be penalized $25. Entries received after August 7th but prior to September 13th will be penalized $50. After September 13th entries will only be accepted with the written consent of all other entrants and the entry fee of $100 will not be refunded.

NATIONAL ADVISORY COMMITTEE MAKES ITS ANNUAL REPORT

PRESIDENT HARDING, in a special message to the Congress forwarding the annual report of the National Advisory Committee for Aeronautics, says that America should be foremost in the development of aviation. He thinks there can be no doubt that the development of aviation will become of great importance for the purposes of commerce as well as for national defense. After pointing out that aviation has not been extensively developed in America, because of lack of wise and necessary legislation, he urges that this condition be remedied by the creation of a bureau in the Department of Commerce for the regulation and development of air navigation.

In its annual report, the National Advisory Committee for Aeronautics urges the enactment of legislation for the devlopment of aviation and for the establishment of airways and airdromes under Federal regulation. The Committee expresses the opinion that if this is done, air lines for the transportation of passengers and of goods will be rapidly established by private enterprise in all parts of the country. The Committee points out, however, that the first transcontinental airways should be carefully planned to serve military as well as commercial needs. The extension of aerological service under the Western Bureau, and the adoption of a policy to sustain and stabilize the aircraft industry, are again urged by the Committee. The continuation of the Air Mail Service under the Post Office Department is recommended until, by the enactment of appropriate legislation, it will become possible for commercial air lines to operate air mail routes. The Committee also recommends the development of airships and the utilization of a small amount of helium at this time, and urges conservation of the great existing resources for future use.

Following is the President's letter transmitting the report to Congress:

To the Congress of the United States:

In compliance with the provisions of the Act of March 3, 1915, establishing the National Advisory Committee for Aeronautics, I transmit herewith the Seventh Annual Report of the Committee for the fiscal year ended June 30, 1921.

I think there can be no doubt that the development of aviation will become of great importance for the purposes of commerce, as well as for national defense. While the material progress in aircraft has been remarkable, the use has not as yet been extensively developed in America. This has been due, in the main, to lack of wise and necessary legislation. Aviation is destined to make great strides, and I believe that America, its birthplace, can and should be foremost in its development.

I therefore urge upon the Congress the advisability of giving heed to the recommendations of the Committee, the first and most important of which is that a bureau be established in the Department of Commerce for the regulation and development of air navigation.

WARREN G. HARDING.

Summary of General Recommendations

The general recommendations of the National Advisory Committee for Aeronautics as contained in its Seventh Annual Report to the Congress are summarized as follows:

Legislation for the Development of Aviation

The most urgent need for the successful development of aviation at the present time, either for military or civil purposes, is the enactment of legislation providing for the Federal regulation of air navigation, and the establishment of airways and airdromes under Federal regulation. The Federal regulation should include the licensing of aviators, aircraft and airdromes; the airways should consist of chains of landing fields providing supply and repair facilities and including the necessary meteorological stations, observations, and reports. If the Federal Government will establish and regulate transcontinental airways as recommended, the committee is confident that air lines for the transportation of passengers or goods will be rapidly established by private enterprise in all parts of the country. The first national airways, however, should be carefully planned to serve military as well as civil needs. The committee reiterates its former recommendations as to the manner of accomplishing the desired results, and urgently recommends the establishment by law of a Bureau of Air Navigation in the Department of Commerce.

Extension of Aerological Service

The committee emphasizes the importance of extending aerological service under the Weather Bureau along airways as established, and recommends that adequate provision of law be made for this service which is so indispensable to the success and safety of air navigation.

Policy to Sustain the Industry

Whatever may have been the faults or the shortcomings of the aircraft industry during or since the war, the fact remains that there must be an aircraft industry, and that it should be kept in such a condition as to be able to expand promptly and properly to meet increased demand in case of emergency. The Government, as the principal consumer, is directly concerned in the matter, and should formulate a policy which would be effective to sustain and stabilize the aeronautical industry and encourage the development of new and improved types of aircraft. In this respect the committee invites attention to the recommendation contained in its special report submitted to the President on April 9, 1921, published as House Document 17, and again recommends the adoption of a policy which, while safeguarding the interests of the Government, will tend to sustain and stabilize the industry.

Importance of Military Aviation

Aviation is indispensable to the Army and to the Navy in warfare, and its relative importance will continue to increase. Other branches of the military services are comparatively well developed, whereas aviation is still in the early stages of its development. The demand for greatly reduced expenditures in the military and naval services should not apply to the air services. The committee recommends that liberal provision be made for the Army and Navy Air Services, not only

(*Concluded on page* 351)

THE MANEUVERS OF GETTING OFF AND LANDING*

By SQUADRON LEADER R. M. HILL, M.C., A.F.C.

PART III.—LANDING

1. Factors Which Particularly Influence "Landing"

(*Concluded from page* 302)

(*g*) The low undercarriage, although it may reduce the angle of the wings to the ground, tends to bring them closer to it. H. Glauert in R. & M. 667 does not seem to attach much importance to the effect of a low wing position, at any rate, for reducing the run. It has been a matter of flying experience, however, that certain aeroplanes whose lower planes were close to the ground, within half a chord, were notably easy to land. The wings definitely felt as if they cushioned against the ground and the aeroplane did not appear to drop a wing so easily. This may have been in some part due to the fact that the proximity of the wing to the ground made it easier for the pilot to judge his height prior to contact; but the fact remains that it was a widely expressed opinion. The couple tending to put the nose down due to cushioning has not, as in getting off, been sensibly noticed by pilots. A large angle of the wings to the ground undoubtedly does reduce the run of the aeroplane, but in landing the pilot feels it more difficult to get his tail down, neither is his position so comfortable, as the nose tends to rise up in front of him and block the view ahead.

(*h*) It is naturally essential for the pilot to have a good view during both phases of landing—as he is gliding down in the approach, as he makes contact, and during the subsequent run. As he approaches, he must be able to see if the landing space ahead is clear, or otherwise he is timid and uncertain in his preliminary maneuvers. When he is about to make contact with the ground, it is unwise to try and gauge the height of the aeroplane from the ground by looking down steeply over the side, and worse still to look back at portions of the aeroplane such as the wheels, even should they be visible. Among other things, his sense of lateral balance is certain to be upset. He should look at the ground about fifty yards ahead, at which distance it does not appear to be moving very rapidly, relate its appearance to the general perspective of objects towards the horizon, and thus judge his attitude relative to the ground. If he looks down at the ground rushing past near to him, its apparently rapid movement tends to unbalance his judgment.

In a few aeroplanes, while the view downward is good, the view forwards is restricted too much by the spar of the top plane being brough too near the level of the eyes—with the object of allowing the pilot to look over it. For landing, he is compelled to look downwards rather than forwards and his judgment is interfered with.

Although experienced night-flying pilots can land at night with little or no illumination, the average pilot needs a set of flares, unless he lands down the beam of a strong searchlight. He has to concentrate not on where he supposes the ground to be, but on the perspective of the flares; when they become nearly superimposed he flattens out.

Within limits the pilot accommodates himself easily to landing large aeroplanes in which his seat is a large vertical distance from the ground. Experience seems to indicate that the lower the pilot is, the easier it is for him to land; but it has not proved how high the pilot can be seated without encountering real difficulty.

Provided the pilot is not at an abnormal distance from the C.G., for landing the position of his seat does not appear to affect him much. If he sits behind the planes, the consciousness of them assists his judgment; on the other hand, his view is so much better if he sits in front that by losing the first advantage he gains the second. It is, however, always helpful to have some sort of fairing in front of him which will assist his idea of the attitude of the aeroplane.

2. General Notes on Landing

In the earlier days of flying the modern "tail down" landing was seldom, if ever, practiced. The aeroplane was glided down, and in case of such scouts as then existed, at an excessive speed for fear of stalling; after which the pilot attempted to run along the ground with the tail up, allowing it gradually to sink down as the aeroplane slowed up. Such landings were nearly always associated with violent bounces, due to uneven ground, and corresponding risk of damage. War conditions forced the pilot to change his attitude. If aeroplanes were to be landed on soft or rough ground in confined spaces, the problem of landing would have to be more finely appreciated. And it was. Consequently the practice was made of getting the tail right down before making contact with the ground, and was not after all found so risky as had been supposed. The risk of dropping a wing, as time went on, was further diminished by better design.

Supposing for the moment that the pilot makes a straight approach to the landing space, he may have some latitude both in the line of his flight and in a lateral direction as to where he may safely make contact so that his subsequent run may be all on good ground. But when, travelling at a minimum of 60 m.p.h., he views the landing space from the air, it looks surprisingly small and gives him an unpleasant sensation of constraint. If the lattitude as to where he may touch the ground in the line of his flight is 300 yards, the maximum period he will have in which to make up his mind is roughly 10 seconds, after which time he will have overshot his mark; or alternatively, assuming a gliding angle of 1 in 6, he must judge his height over an obstacle within 150 ft. The flatter the gliding angle of his aeroplane, the more will this margin contract. As a matter of fact, the pilot very seldom attempts to judge a straight up-wind glide; he approaches the landing space with a margin of height, and loses it by a series of maneuvers which will be discussed later.

Associated with the tail up landing practiced in earlier days was a kind of rapid flattening out. The aeroplane was glided down and, until it was within a few feet of the ground, flattening out was postponed, and was correspondingly violent. The pilot then allowed the wheels to touch and so ran along until the aeroplane came to rest. This kind of flattening out, however, can be made in conjunction with a tail down landing, which means that the pilot keeps the aeroplane near to the ground without making contact until it stalls. The greater the speed at the time of flattening out, the longer the period before contact with the ground. This holding the aeroplane near to the ground is a severe tax on the pilot's mental concentration, as the flying qualities change with the loss of speed and the controls require the most delicate handling. If the pilot becomes fatigued, he lets the aeroplane either touch the ground too soon or curve up into the air again and stall too high.

Most pilots therefore try to diminish the period close to the ground by commencing to flatten out at from 20 ft. to 30 ft. up, thus approaching the ground more gradually. If the pilot could fortell the precise moment at which the aeroplane was in a suitable condition for contact with the ground, he need never consciously hold the aeroplane near to it; in practice he dare not risk such an accurate forecast, and always tries to allow at least a small period to elapse while he holds the aeroplane very close to the ground, awaiting the final condition of stalling. Pilots often refer to this as "flying the aeroplane right out." In forced landings the pilot may elect to bring the aeroplane in so slow and right on the edge of his controlling powers, that the period referred to becomes sensibly zero. But should his judgment be in the slightest degree out, a crash is inevitable, especially as he may have no engine to accelerate him at the last moment.

The normal gradual flattening out may actually be associated with a maneuver such as turning or side-slipping, by which it is apparently masked; but the pilot must so arrange the maneuver that a form of flattening out is really inherent in it.

In landing, as in getting off, the pilot is concerned with three things: his attitude, the horizontal component of his velocity relative to the ground, and the vertical component; the relative magnitude of which two components determines his gliding angle. The pilot arrives at a point from 20 ft. to 30 ft. above the ground, gliding at some speed at which he has a reasonable margin of control. From this point his path becomes curved; at any moment the lift of the aeroplane is just greater than the weight, and immediately prior to contact with the ground, the vertical component of his velocity should be reduced for a perfect landing nearly to zero. Now, neglecting the effect of the propeller, there are two factors which influence the control movement necessary to produce the required path. Firstly, the stalling moment necessary to be produced by the elevators; and secondly, the negative acceleration at any moment during the time that the attitude of the aeroplane is changing; for as the speed drops, the resistance at any moment changes. At some moment prior to stalling, the aeroplane may pass through an attitude of minimum resistance. This attitude, on the other hand, may be that corresponding to the speed at which the aeroplane is gliding when the flattening out commences; in most cases it is probably in the neighborhood of this speed.

Suppose that the aeroplane is initially gliding at its best gliding angle, that is, with minimum resistance; and suppose the speed which corresponds to this is 60 m.p.h. The subsequent curvature of its path will be associated with the alteration of its attitude and its corresponding loss of speed, the whole being made to culminate in the desired conditions just prior to contact with the ground. The pilot, by the use of his elevators, has to ensure that speed is gradually and steadily diminished throughout the curved path, and this dictates his attitude. Immediately the pilot commences to flatten out the aeroplane, which is assumed to be gliding at its best angle at 60 m.p.h., he will drop the speed. But at this lower speed the resistance will increase, and progressively so towards stalling. So to produce the curvature of path that he desires, the speed must decrease more and more rapidly as the ground is approached, and the attitude of the aeroplane must be altered to correspond, or the pilot will fly into the ground. The pilot does allow for it by a progressively more decided use of the elevators. As it happens, he has to use his elevators more decidedly as the speed drops, for two reasons: firstly, for the one mentioned, and secondly, because as the speed drops the control becomes increasingly less effective. It is, of course, by his sense of the rate of approach of the ground that the pilot allows for all these somewhat complex effects. It is emphasized here that the progression is all towards using the control more decidedly as the stall is approached.

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* Lecture delivered before the British Aeronautical Society.

But now suppose that the pilot, possibly for fear of stalling the aeroplane because he is being bumped about on a rough day, glides the same aeroplane in at 75 m.p.h. The resistance at 75 m.p.h. is greater than at 60 m.p.h.; so if his path is straight, the vertical component of his velocity is greater. When he commences to curve his path, the approach towards the attitude of minimum resistance requires a progressively less vigorous control movement to flatten the aeroplane out relatively to the ground; but there will come a critical time when the attitude of minimum resistance is passed and it becomes steadily greater. It is here that the pilot is likely to be deceived. The fall of resistance and the sensitiveness of the control at the higher speed, at first seemed to stave off the approach of the ground with a negligible effort on his part. After the critical point, he suddenly finds himself into the ground with a violent bounce, because he has not allowed for the more rapid decrease of speed. It is suggested that the above may be an explanation of why the pilot so often tends to fly into the ground if he glides in fast, that is, at a speed greater than that which corresponds to the attitude of minimum resistance or best gliding angle. On the other hand, the effects described above are probably masked in many cases by the stability characteristics of the aeroplane.

Whether the pilot curves his path gradually over a long period, or suddenly over a short one, the above remarks apply in the main. Th advantage of not having to hold the aeroplane close to the ground for a protracted period, while it "flies itself out," is seen to be that the consequence of a slight error in the allowance for the change of the vertical component of the aeroplane's velocity is not so likely to be followed by a violent bounce. More times than not, a pilot involuntarily performs the high-speed rapid flattening out type of landing through an ungovernable shrinking from a reduction of speed, especially when the air is disturbed. In reality the type in which he gradually flattens out is his ideal of good style. As in all flying, violent control movements, unless dictated by imperative conditions, are the result of subconscious timidity or uncertainty of the pilot.

H. Glauert states in R. & M. 667 that a reversible airscrew would be of the greatest assistance in reducing the space required for landing. As long as the success of a landing is so intimately bound up with an exquisite kind of judgment, it would be difficult for the pilot to operate any kind of auxiliary control once he came under the influence of the ground, however useful it might prove in reducing the landing space. H. Glauert further points out that a reversible airscrew would not be available in the case of a forced landing without engine. It might be added that the pilot would be precluded from using his engine to increase the curvature of his path, should he need it at a critical moment.

If there is a wind, the pilot always lands against it. Just as the wind gradient near the ground assisted him in getting off, it disturbs him in landing. If the pilot lands against a strong head wind, he often, as he approaches the ground, feels himself unaccountably dropping. This must in many cases mean that he tends to lose speed without realizing it, due to the drop in the velocity of the wind near ground level. With the exception of this effect, there is nothing to fear from landing into a strong wind, as the actual speed of the wheels relative to the ground when contact is made is very low, and the subsequent run correspondingly short. It is a curious fact that when landing into a strong wind pilots so frequently tend to make contact with the ground with the tail up. This must be because they feel themselves travelling so much more slowly relatively to the ground that they are led into believing that stalling speed has been reached and that the aeroplane is ready for contact with the ground.

Although it has been pointed out that the pilot nearly always loses height near the edge of the aerodrome by maneuvering as a matter of course, these maneuvers will be considered in the paragraph dealing with forced landings, in which they are the decisive factor. Landing across wind, although sometimes deliberately practised, will be dealt with in a similar way. Landing down wind is not considered, as a modern aeroplane cannot be landed down a wind of any strength without the most severe risk of a crash. Furthermore, there seem to be no particular methods by which the pilot can diminish this risk.

3. "Landing" as a Forced Maneuver

Engine failure in the air means a forced landing, which, as has been stated before, is usually taken as the ultimate test of the pilot's skill and judgment. Sometimes the pilot is able to avail himself of a small amount of engine, which, though it will not enable him to climb up and try a second landing should he misjudge at the first attempt, serves to prolong his glide. The breakage of any essential part of the engine usually means switching it off altogether. If such a breakage occurs on a twin-engined aeroplane, unless the pilot can stop the propeller of the damaged engine, he will probably find it necessary to glide down as quickly as possible owing to the liability of very severe vibration being set up and the consequent menace to the aeroplane structure.

As in getting off, it is usually the obstacles which surround possible landing spaces that constitute the difficulty; so, especially if the gliding angle is flat, the pilot must, if for no other reason, have recourse to maneuvers to bring the aeroplane to the ground as soon after the obstacles as possible.

Engine failure may occur either at the beginning of the third phase of getting off, when the wheels have just left the ground, or towards the end of the third phase; or when the pilot is well up and free from the influence of the ground. In the first case the pilot is compelled to effect a landing immediately in his projected line of flight, trusting that he will not overrun the limits of good ground before coming to rest. Landing under these circumstances is difficult to execute without very severe bouncing and consequent risk of damage. The pilot finds himself somewhere near his best climbing speed, close to the ground, with the slipstream effects suddenly eliminated. Depending on how close he is to the ground, there are two courses open to him. If he is only 3 ft. to 6 ft. up, he may, without moving his longitudinal control, allow the aeroplane to sink on to the ground, due to loss of engine power, and trust that it will make contact more or less in stalling attitude. If, however, he is 20 ft. to 30 ft. up, he may attempt to put the nose down and induce a kind of glide from which he may hope to flatten out in the usual way. He must remember that the aeroplane will be sluggish in answering to the longitudinal control, that after engine failure it will begin to sink rapidly, and that if it answers sluggishly to the longitudinal control and only starts putting its nose down as it approaches the ground, there is no hope of flattening out; it were better that the pilot had attempted to keep flat from the moment of engine failure and trusted that the stalling moment of the elevators would be sufficient to hold in check the nose-diving couple until the wheels touched. Just whether or not the pilot will decide to put his nose down when the engine fails close to the ground is a critical test of his judgment.

If the engine fails towards the end of the third phase of getting off, the pilot has to choose between going straight on or attempting a backward turn. This has been discussed in Part II., para. (3). It was noted that if the pilot does elect to turn back, it is safer to dive and gain speed before commencing the turn than to commence the turn and try to gain speed while turning. It was a part of the teaching of the Gosport School of Special Flying, which initiated the modern conception of aerial maneuver, that if the engine failed and the pilot judged that he could turn back, it was safest for him to dive down and carry out the banked turn with his inner wing tip close to the ground. If then at any moment his available margin of speed disappeared, he could effect a landing without the risk of a nose dive.

Lastly, if the engine fails when the pilot is well up, the first phase of landing may be said to commence when he puts the nose down and commences to glide. From this moment he maneuvers for position by gliding towards the most open-looking stretch of country. On the whole it is not worth while, except in a very wide sense, selecting a landing place from above 5,000 ft., as local features are too obscure; and once the pilot has committed himself to the idea of landing in one place, it is disturbing to be compelled to change his mind later on. If possible, the pilot should attempt to arrange his glide so that he will pass over the selected landing place at an altitude not exceeding 2,000 ft., to enable him to make one good inspection. This he can do by gliding over it down wind. After that the general idea will be to approach the landing space with a margin of height to avoid the risk of undershooting, and lose this height by maneuver. Every pilot has some particular way of maneuvering to lose height that he considers safest and most efficacious.

The simplest way, if the field has breadth at right angles to the wind direction, is to make use of this breadth by approaching the field just short of one edge at right angles to the wind. The pilot has then a certain latitude of time in which he can turn up wind, during which time he is losing height and is yet within range of the landing space. He can further assist his rate of losing height before turning up wind by sideslipping in the down wind direction. The wing farthest from the landing space will then be depressed, and the turn up wind will help him off the sideslip, as in itself it ensures the lifting of the depressed wing in order to bank for the turn.

A method of losing height that was in greater vogue formerly than to-day was to approach the landing space with a margin of height and then lose it by a series of partial turns, first one way and then the other, usually termed S-turns. This method enables the pilot to lose height quickly, but it has disadvantages. Firstly, by the complication of the maneuver, the pilot tends to become confused in sense of direction; and secondly, it is difficult to execute turns with the engine off without unconsciously increasing the speed, due perhaps to the pilot's instinctive fear of lateral instability at low speeds.

A modification of this method gives a still more rapid method of losing height. Instead of carrying out properly banked S-turns, the pilot does flat turns, yawing the aeroplane violently from side to side, up to as much as 60 or 70 degrees from his line of glide. For each flat turn he gives a turning impulse with the rudder and uses the ailerons against instead of with it, allowing the yawing moment due to the ailerons to increase the flat turn; which virtually amounts to letting the aeroplane take charge and then recovering. The aeroplane loses height with surprising rapidity, but the margin of control is too small for anyone but an extremely skilled pilot to practise this maneuver.

A method which has the advantage of being a steady, even maneuver is the "sideslip" landing. It commends itself as being effective, reasonably safe and not liable to confuse the pilot, who simply puts one wing down and maintains a steady sideslip, varying the steepness according to the rapidity with which he wishes to lose height. It is an advantage if he allows the aeroplane to slew slightly, so that as he glides down the depressed wing is forward of the raised wing; for the nose of the aeroplane is then not in front of his eyes as he looks down at the place he intends to land on, and allows him a particularly good view. When the aeroplane approaches the ground the pilot straightens it out and effects a landing in the ordinary way. A perfectly clean recovery from such a sideslip is not unattended with difficulty, and the pilot may find himself drifting sideways, due to imperfect co-ordination of his controls. Most undercarriages will not stand up to lateral loads of any magnitude, and it is peculiarly important that the pilot should make contact with the ground without drift. As a last resource, the pilot can drop one wing, thus causing sideslip the opposite way in order to neutralize the drift. If he does this with skill, he will effect a landing on one wheel without damage. After running a few yards, the aeroplane will sink down on its other wheel and come to rest in the normal way.

The above methods of approach have been detailed separately; the actual practice of pilots is very difficult to analyze; the way in which an experienced pilot loses height is frequently a combination of feature peculiar to these methods that is influenced by local conditions, because every forced landing in a confined space surrounded by obstacles is a different problem.

The pilot may sometimes be compelled to land across wind if the landing space is narrow and the wind is blowing across it. He therefore finds himself drifting badly as he approaches the ground. The most effective way of neutralizing this is by the method referred to, *i. e.*, dropping a wing and landing on one wheel. There is still another method, which consists in putting on full rudder at the last moment before contact and inducing a flat turn towards the down wind direction, which has the effect of causing the aeroplane to skid sideways in the up wind direction and of tending to neutralize the drift. Owing, however, to the uncertain action of the rudder at such a low speed, this method is generally less effective than the previous one. Neither method, of course, is resorted to unless it seems likely that the undercarriage will collapse sideways if the drift is not neutralized.

On lightly loaded aeroplanes it is sometimes possible to make a very slow landing by producing a sideways skid close to the ground with the rudder and making a recovery just before contact, but on heavily loaded ones it is almost impossible.

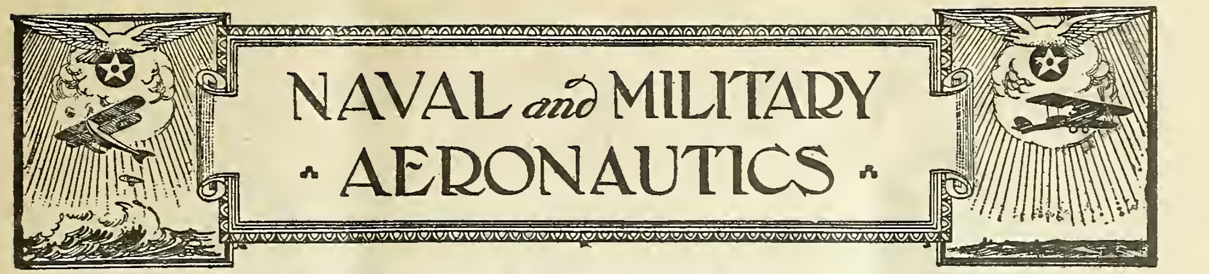
If the pilot finds that he is running into bad ground towards the end of the second phase of landing, he attempts to spin the aeroplane round on the ground with the last of his rudder control. An emergency device on the tail skid, in the form of a sprag, might be of use under these conditions. Its braking action could be made so severe that the ground would be torn up and the rear of the fuselage possibly damaged. It would never be used under normal circumstances, but it might be useful in preventing the aeroplane colliding with an obstacle at the last moment, or turning over on its back in bad ground at the end of its run.

Should the pilot be compelled to land on undulating ground, a comparatively steep uphill gradient is easier to land on than even a gentle downhill one, unless the aeroplane has efficient wheel brakes. In order to land uphill, the pilot must leave himself a greater margin of speed with which to flatten out; the actual flattening out will also have to be of a violent nature.

In making a forced landing without engine from a great height the pilot's difficulties of judging the landing are increased. As he glides down he thinks in terms of thousands of feet, and, if he has no chance of flying round for a short time low down, he finds it difficult to think in terms of inches, just prior to contact. If he misjudges his glide he may have to pass over obstacles at a dangerously low speed, and as he finally approaches the ground he will find that the vertical component of his velocity is very large. The best thing for him to do is to concentrate the whole of his flattening out in a violent jerk at the last moment, using his elevator control to the full extent rather than attempt a gradual flattening out. Similarly, if he is compelled to glide at a very low speed to reach the safe landing place, he must practise the greatest economy with his control movements; the slightest unnecessary control movement means loss of height which he cannot afford when he is trying to eke out to the uttermost his fast disappearing margin of control.

Finally, if the pilot is compelled to approach ground on the surface of which it is impossible to make a landing in the accepted sense of the word, he will do best to keep a good margin of speed and control until the last moment, when he can expend this by pulling the nose up with a violent jerk, trusting that he will drop flat before the nose-diving couple comes into play. If he remains sufficiently cool, it should be possible for a pilot, keeping his speed till the last moment and then jerking the aeroplane up on its tail, to place it on the sloping roof of a house. A longitudinal shock is bound to injure the piloth; if remembering that his wings will absorb a shock of extreme violence, he can avoid colliding with an obstacle nose on, he may then hope to escape severe injury. A simple example of this is the contrast between striking a tree nose on and allowing the nose of the fuselage to pass between two trees and so taking the whole shock on the wings.

There is a certain point after which it is impossible not to wreck the aeroplane; pilots so often lose their lives and those of their passengers in attempting the impossible by overstepping the margin of speed and control of the aeroplane in the vain attempt to bring it down intact; in other words, once the pilot has decided that it is impossible to save the aeroplane, he must simply regard it as a shock absorber, and crash it, so far as possible, with the minimum risk to his crew.



NAVAL and MILITARY AERONAUTICS

Sergeant Chambers' Record Parachute Jump

Commenting on the parachute jump from a height of 26,000 feet made by Sergeant Chambers, U. S. Army Air Service, at Kansas City, on November 1st, and the fact that, during the course of his descent, he lighted and smoked a cigarette, a British aeronautical journal states that "while this is doubtless a record it is very unconvincing, and is about on a par with the "record de loopings" so much sought after by certain aerial acrobats; both of which are more tests of physical fitness rather than of aeronautical progress. When one has heard that someone has jumped 26 feet and landed safely, and not smoked a cigarette whilst on duty, then perhaps parachutes will be regarded as aerial 'lifebelts' and not as aerial trapezes."

A Dayton, Ohio, paper considers that "the exploit, merely as a record breaker, means nothing. A fall of one-tenth, even one hundredth part of the distance, would be fatal. Altitude merely increases the certainty of mutilation, not the chance of escaping death or injury. But as showing the efficiency of modern parachutes and thus indirectly increasing the safety of the aeroplane, the record is of great value. The aeroplane probably never can be made perfectly and entirely safe any more than the automobile can be made safe against falling off bridges or upending in ditches, or the ship safe against going to the bottom when it is not watertight. But the parachute, in the sense that lifeboats and life-preservers help to make voyages on water less unsafe, is a valuable adjunct to the airplane. Its development to the point of the safety offered by lifeboats and life-preservers will hasten not a little the period of general use of the aeroplane as a practical utility for pleasure or commerce."

Night Flying at Kelly Field

Preparations have been made at Kelly Field, San Antonio, Texas, for night flying, beginning the early part of December, if conditions permit. The new Xbia planes, attached to the 13th Squadron for service tests, will be used. Almost all known tests have been applied to these ships, except cross country flying and their manoeuverability in muddy landing fields. Captain Lloyd L. Harvey, the squadron commander, has requested permission to fly one of these ships to El Paso, Texas, on cross-country, and it is thought that this trip will complete the required tests. A number of suggestions for improvements have been received from the officers who have flown these ships, the most prominent among them being the provision of some means of eliminating the excessive friction in the ailerons and elevators.

An Aeroplane Flight to Tall Volcano

On September 28th two aeroplane formations, led respectively by Major A. H. Gilkeson, Commanding Officer of Clark Field, Pampanga, P. I., and Captain Lloyd N. Keesling, Field Adjutant, flew on mapping and practice reconnaissance missions to Los Banos and Santa Cruz on Laguna de Bay, approximately eighty miles south of Clark Field. Both flights made side trips to Taal Volcano, which was enthusiastically reported on upon the return of the flights as being unique in geological formation and its beauty of environment. History records severe eruptions as having taken place as late as 1754. Captain Keesling mentions it in his reconnaissance report as a monument to the past ages of indiscribable destruction and ruin.

The approach to the volcano is over extremely rough and heavily covered country. Lake Taal, which entirely surrounds the mountain like a broad moat, is then reached. From this Taal Mountain rises probably a sheer five hundred feet, appearing from the side like an inverted cone, its apex broken off, and vertically from the air like a huge doughnut. Within the crater, which is estimated as being half a mile in diameter, lies an emerald green lake and still within this lake lies another small island. The sides of the cone are devoid of all vegetation. The peaks bordering the crater lake are irregular and sharply jagged. First Lieutenant C. L. Webber, who visited the location on the ground, reports Lake Taal as abounding in fish and, incidentally, less attractive forms of tropical life.

Langley Field Times

The Langley Field Times celebrated its third anniversary on December 3, and we extend to its editors our cordial congratulations on their success in getting out a really worth while service publication. More power to them!

Major A. G. Fisher Receives Promotion

Major Arthur G. Fisher, Commanding Officer of the Airship Section, Langley Field, has received notification of his promotion to Lieutenant-Colonel. Col. Fisher's commission will date from last April.

Helium Filled Airship Visits Langley Field

The U. S. Navy Airship C-7, the first airship to use helium gas, flew over this section and landed at Langley Field, Thursday. The capacity of the C-7 is 181,000 cubic feet.

The Naval officers in charge of the ship say that a high degree of efficiency was attained with the helium gas, but that the lifting power of the ship is not so great as when filled with hydrogen gas. The advantage in using helium gas is greater safety as it is non inflammable and will not explode. The envelope of the C-7 contains practically all of the world's supply of this new gas. A plant for producing helium is being installed at Langley Field and when completed will be one of the two helium producing plants in the United States, the other will probably be located on the Pacific Coast.

National Advisory Committee Makes Its Annual Report

(*Concluded from page 347*)

that provisions be made for the maintenance and training of personnel, but also that the funds be adequate to insure the fullest development of aviation for military and naval purposes.

Scientific Research

Substantial progress in aeronautical development, whether for military or commercial purposes, must be based upon the application to the problems of flight of scientific principles and the results of research. The exact prescribed function of the National Advisory Committee for Aeronautics is the prosecution and coördination of scientific research, and, while encouragement may be taken from the progress made, greater provision for the continuous prosecution of researches on a larger scale is strongly recommended by the committee.

The Air Mail Service

The Air Mail Service has demonstrated that airplanes can be utilized with certain advantages in carrying the mails. And it has done more than this, despite the handicap of using military types of aircraft, poorly adapted to its work or to any civil or commercial purpose in demonstrating that commercial aviation for the transportation of passengers or goods is feasible. There are several causes which are delaying the development of civil aviation, such as the lack of airways, landing fields, aerological service, and aircraft properly designed for commercial uses. The Air Mail Service stands out as a pioneer agency, overcoming these handicaps and blazing the way, so to speak, for the practical development of commercial aviation. As a permanent proposition, however, the Post Office Department, as its functions are now conceived, should no more operate directly a special air mail service than it should operate a special railroad mail service, but until such time as the necessary aids to commercial aviation have been established it will be next to impossible for any private corporation to operate under contract an air mail service in competition with the railroads. The National Advisory Committee for Aeronautics therefore recommends that provision be made for the continuation of the Air Mail Service under the Post Office Department.

Helium and Airships

The United States has a virtual monopoly of the known sources of supply of helium, and these are limited. Experiments have been conducted by the Bureau of Mines with a view to the development of methods of production and storage, but as yet the problem of storage in large quantities has not been satisfactorily solved. Because the known supply is limited, because it is escaping into the atmosphere at an estimated rate sufficient to fill four large airships weekly, and because of the tremendously increased value and safety which the use of helium would give to airships, particularly in warfare, it is, in the opinion of the National Advisory Committee for Aeronautics, the very essence of wisdom and prudence to provide for the conservation of large reserves through the acquisition and sealing by the Government of the best helium-producing fields. Attention now being given to the development of types of airships to realize fully the advantages which the use of helium would afford should be continued. Such development would give America advantages, for purposes either of war or commerce, with which no other nation could successfully compete.

FOREIGN NEWS

Canadian Activities

A draft plan for the training of university cadets by the Canadian Air Force, and by that means providing a reserve of flyers and areonautical mechanics in case of need, has been submitted by the Air Board to the various heads of universities in Canada for consideration and comment. The plan includes the giving of a three months' course for three consecutive years to university students who are desirous of studying aeronautical engineering where they can secure first-hand information. The number taking the first course, which is proposed for opening about May 1, 1922, will be limited to 30. Students must be under 21 years and unmarried, and physically fit for military service.

At the request of the Department of Militia and Defence, a complete aerial survey has been made of the Petawawa Military Reserve, comprising approximately 240 square miles. Photographs were taken from a Bristol fighter at an altitude of 8,000 feet, giving a mosaic 1/8000, which when completed and mounted on beaver board was twelve by fifteen feet in size. It was afterward reduced by the Department of Militia and Defence to a scale of 1/20,000. The photographs turned out remarkably well and all concerned expressed satisfaction, as full details were given in all sections of the photographs to enable an accurate map to be made. Six hundred feet of film, giving approximately 600 exposures, and about fifteen actual flying hours were required for the purpose of obtaining the pictures.

Inauguration of the Peking-Tsinan Air Service

Brilliant sunshine and a great crowd of Chinese, foreign guests and interested onlookers witnessed the inauguration recently of the Peking-Tsinan Aerial Service. As became such an epoch-making event, the ceremony was planned on an elaborate scale by the Chinese Aeronautical Department, a special pavilion being erected for the speech making, which was later used for a tea party after the first machine had taken to the air enroute for Tsinan. Incidental music furnished by the band of the Ministry of War enlivened the proceedings at intervals. On the invitation of the Department of Aeronautics, many persons were taken up for flying trips on a Vimy-Commercial piloted by Captains Lewis and Jones. Lieut. T. Y. Chen, flying an "Avro," was the stunt artist of the afternoon. Promptly at 4:45 P. M., the Cheng Ku (the name of a Vimy Commercial aeroplane) left the airdrome for Tsinan, carrying a full load of passengers and 600 lbs. of mail, destined for all parts of the world. Major Batterson (the senior pilot at Nanyuan) was in the cockpit with Lieut. Tsao. The passengers included Colonel Holt, D.S.O., C.M.G. (Adviser to the Aeronautical Department), representatives of the Aeronautical Department and Chinese Post Office, and several newspaper correspondents.

Addresses were made by General Yin Chang (representing the President), General Mo Tsun-chin and General M. K. Ting (Director of the Aeronautical Department). A message from Premier Chin, expressing his pleasure at the opening of the Peking-Tsinan Air Service, was read by General Shu Chin-Yuan.

Air Lines in Portugal

The government has received an application from a Paris group asking for a grant for fifty years to establish aeroplane lines between Lisbon, Oporto, Madrid and Paris.

Chinese Aeronautics

General Pan Chu Ying, the newly appointed Director of the Aeronautical Department, assumed his official duty on July 15th.

Mr. T. H. Chang, a returned Chinese student from the United States, has been engaged by the Aeronautical Department as pilot instructor in the Nanyuan Flying School. He is a graduate of the Virginia Military College and has received a complete course of instruction in Aeronautics in the Diggins Aviation School. He has passed the examination for International Pilot's license.

The section between Peking and Tsinan of the Peking-Shanghai Air Line has been carrying mails regularly since July 1st. It is now planned to carry passengers also, the fare for a single trip, either direction, being $50.

On June 27th, a "Vimy-Commercial" named in Chinese "Ta Peng" or "Great Bird", had two trial flights between Peking and Tsinan, a distance of 180 miles, without accident. In spite of the rather rough weather, the machine accomplished her maiden trip between these two points in 2 hours and 15 minutes. The return trip from Tsinan to Peking occupied 3 hours and 15 minutes, its progress being retarded by a strong northern gale.

The Chinese Government has recently issued a set of five special postage stamps for use on the Peking-Shanghai air line.

Swiss Aeronautics

The Federal Aerial Office has issued a notice to the effect that, by order of the German Department of Transportation, aeroplanes of a military type constructed in Germany are no longer permitted to circulate in the air over that country. This prohibition also applies to civil aeroplanes registered in Switzerland but belonging to the aeroplane types prohibited in Germany, provided their papers do not contain a special certificate having come from the German Minister of Transportation stating that they were constructed before January 10, 1920.

A new air service which completes the connection between London and the Swiss winter resorts was opened by a French firm recently. The new air line runs from Paris to Lausanne. At present it is necessary for passengers leaving the Croydon airdrome at London by one of the air expresses to spend the afternoon and night in Paris, leaving for Lausanne next morning. It is, however, hoped to so arrange the service ultimately that the whole journey can be completed on the same day, with just a short stop at le Bourget (Paris).

Government Interest in Siam

It appears that the Government of Siam is taking considerable interest in aviation. Recently, it is reported, airdromes have been opened in various provinces, and machines are being or are to be imported from France and England to Bangkok. As the roads are not of the best, aeroplane services should have the effect of speeding-up considerably the inter-communication between the various provinces.

Traffic in the Netherlands

From a traffic point of view it appears that Amsterdam has become the third largest air station. During the period between April 14 and October 3, no fewer than 1,000 machines passed in and out of the station and carried—in addition to large quantities of goods and mail—1,511 passengers.

Subsidies by France for Civil Aeronautics

In 1921 France granted a sum of 27,885,008 francs in bonuses and subsidies to aerial navigation companies for working the following lines:

Paris-London; Paris-Brussels-Amsterdam; Paris-Strasbourg-Prague-Warsaw; Toulouse-Rabat-Casablanca; Bayonne-Nilbao-Santander; Bordeaux-Toulouse-Montpellier; Saint Laurent-Cayenne, and Saint Laurent-Inini.

For the year 1922 these lines are to be continued, and the following additional lines opened:

Antibes-Tunis; Bucharest-Constantinople; Oran-Casablanca; Algiers-Biska; Dakar-Kayes; Montpellier-Marseilles-Genoa.

This accounts for an increase of 9,137,000 francs in subsidies. The remainder of the subsidies requested will go to Civil Centres of Training for reserve pilots. Excellent results have been achieved by these Training Centres.

British Aeronautics

Of the 27 machines turned out by the Aircraft Disposal Company, Ltd., for the Spanish Government, and which were to have been flown to Spain, 22 have arrived successfully. The remainder were damaged through forced landings due to minor defects, compelling the pilot to land on some impossible country over which they had to pass. Taking into consideration the fact that these were not special machines but merely disposal stuff which had been standing idle for two years or so, and that owing to the urgency with which they were required they were hurried together without time for special tuning, this feat is considered quite noteworthy.

A large aeroplane, which has been undergoing speed trials at Farnborough for the past few weeks, will probably be put through a full test very shortly. This machine is the biggest in the Royal Air Force. With its twin Siddeley-Deasy engines it can develop nearly 1,000 h.p. It has fighting turrets on each side of the fuselage, with provision for machine gunners and bombers. In the trials it will probably carry a crew of ten, which, with the weight of the machine and its complement of guns, will bring the gross weight to something like ten tons.

Croydon Aerodrome (London) has now a fresh point of interest for the visitor. The Air Ministry authorities have erected a large map showing the airways of Europe in black lines. Along these routes, at intervals representing ten miles, are nails on which small models of aeroplanes, marked with the sign of the respective companies, are hung. When a machine leaves Croydon, or is signalled as having left another aerodrome for Croydon, its representative is placed on the map. An attendant moves it along the route from time to time, its progress being worked out by means of a knowledge of the speed of the machine. As many aircraft are now fitted with wireless, the pilot will signal down his position from time to time so that the position of the model on the board may be checked. Already firms, and friends of passengers, are finding the map of great use, while visitors to the aerodrome appear very interested in watching the progress of the machines which they have seen leave.

The Air Conference

The British Air Ministry announces:

The first Air Conference proved so useful in focussing attention on the many and intricate problems of aviation and in bringing about a frank exchange of views on the subject, that the Air Council has decided to call together another conference. This second air parliament will be held by permission of the Lord Mayor and Corporation at the Guildhall on February 7 and 8, 1922.

The Conference, which will be opened by the Lord Mayor, will, on this occasion, be asked to address itself mainly to the question of the future of aviation, with special reference to its development as a regular and speedy form of commercial transport.

At a matter of convenience the papers will be divided into two main groups, the one dealing with civil aviation in general and the other with technical problems, the papers on the former subject being delivered at the morning session of the first day, and the papers on the latter during the afternoon session of the same day. The proceedings on the second day will be devoted wholly to discussion arising out of the previous day's papers, the morning sessions being allotted to civil aviation and the afternoon to discussions on the technical papers.

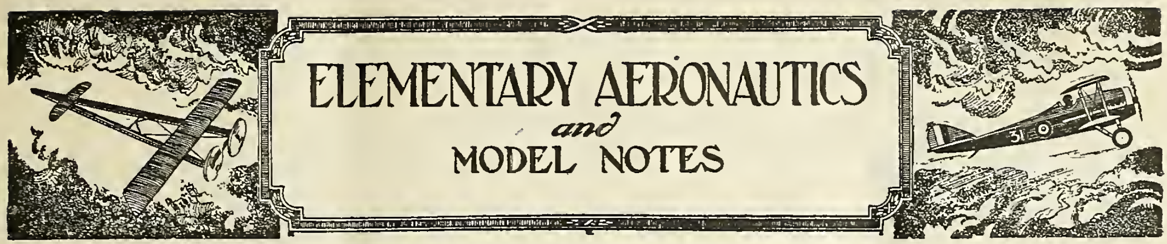
There will be two chairmen; the Secretary of State for Air, who will preside during the civil aviation portion of the proceedings, and Lord Weir of Eastwood during the technical sessions.

The principal paper on civil aviation will be read by Lord Gorell, Under Secretary of State for Air, who will give a general account of progress at home and abroad, and will direct attention to a consideration of the ways and means whereby the development of civil aviation at home and in the Empire may be best furthered; in this connection Lord Gorell will endeavor to enlist the practical cooperation of business and other interests.

The main technical paper will be read by Mr. F. M. Green, of Sir W. G. Armstrong, Whitworth Aircraft Limited; the names of the other speakers will be communicated later.

In order that the Conference may be fully representative of all sections of the community who are now interested in the development of aeronautics or who are considered to have a potential and growing interest in air transport development, special invitations are being issued to all coming within these categories, particular efforts being made to secure, so far as possible, the attendance of representatives of large business groups and organizations.

Arrangements are being made which will permit all members of the Conference who desire to do so visiting the London terminal aerodrome at Croyden on Monday, February 6th. The operations of the various Continental air transport companies will then be seen and explained; in addition, as many types of civil aircraft as possible will be concentrated at Croydon to afford members an opportunity of seeing for themselves the range which is being covered by commercial designs. Demonstrators of amphibian aircraft alighting on the Thames will also take place during the period of the Conference.



ELEMENTARY AERONAUTICS *and* MODEL NOTES

An Analysis of Soaring Flight

By A. O. Henrich, Member of the L. I. Flight Association

FOR a long time I have been very much interested in the flight of birds, particularly in the gliding flight of the larger soaring birds. I have given quite some time to the study of these birds whenever opportunity offered, and have tried to discover the secret of their soaring flight with the object in view of applying it to an apparatus capable of carrying a man and staying aloft for long periods if not a more or less indefinite time.

From what I have been able to learn I have formed two conclusions: either the secret of soaring flight is so complicated as to be beyond the grasp of human brains and hands, or it is so simple that its very simplicity has blinded our eyes to the exclusion of this much sought-after power. Of the two opinions I am much more inclined to the latter for a great many reasons, some of which I will mention:

In the first place we must not take for granted that all we see a bird do or fail to do while in the act of soaring as any proof that it is or is not capable of doing the reverse or the same for a longer or shorter period of time if it so wishes. We must bear in mind at all times that birds are not (at least in most cases) performing for their own sport or edification, and that they are not, for instance, trying to stay aloft for a great time without a single wing flap, but in most cases are either in search of food or are travelling from one place to another and are therefore following the line of least resistance, so to speak, and will either travel entirely by soaring or by flapping flight or by both, as may best suit their needs and present conditions. Also the fact that a soaring bird will, at irregular intervals, resort to a slow flap or more while in the act of soaring, does not show that it was absolutely necessary to prolong the flight, for I do not think there is enough actual power derived from some of these wing strokes to be of any material benefit to the forward motion of the bird and certainly not enough to help it through any gusts or turbulent air. I do think, however, that the half dozen or more quick flaps are for the purpose of helping it through a downward trend or to make better headway against a gust. In the first case the bird does not want to lose altitude, and in the second does not want to lose its forward speed, and that either could have been actually dispensed with if the bird so desired so far as the elongation of the flight was concerned. I may be altogether mistaken in this belief but do not think so, as I am very much of the opinion that any of our best soaring birds (if they so desired) could stay aloft for a more or less indefinite period without a single wing flap in almost any kind of weather. As I said before, I believe that the act of soaring is much more simple than some of us may think and can be largely if not altogether imitated by man in a properly designed and suitably constructed apparatus handled in such a way as to get the most power out of the internal forces of the wind. I do not believe that a bird, for even a short time, searches for or tries to use any power it may get from an upward trend or column of warm or any other kind of air, and think we should leave such thoughts out of our calculations when dealing with soaring flights of either a mechanical or natural nature. Here again I may be mistaken and will welcome any proofs in contradiction of this view.

It has long been my belief that a bird soars very much if not quite after the manner in which a sail boat is propelled by the internal forces of the wind and by no other method. Just as we can sail a well-balanced boat in any direction, so can a bird sail in any direction and so can a well-balanced and properly handled soaring machine be made to sail, and for periods of as long or short a time as we choose to make them. In the case of a boat we have the water which floats the apparatus and holds it more or less in balance. The sail is very much like the wing of a bird or plane, but is in a vertical position. The force of the wind in this sail or wing creates a strong pressure which tends to push our boat sidewise or before it, at the same time pushing or pulling it forward. The hull resists the sidewise motion somewhat and the boat moves forward, but with some sidewise way on as well. If we consider the wings of a bird or a soaring apparatus as a sail, but in a horizontal position rather than a vertical, the same forces would be brought to bear, only in this case we must have our plane light enough so that the wind can lift it and it must be much more delicately balanced than the sailboat. In this case gravity, acting on the weight of our machine, would act in pretty much the same way as our boat in the water, as the weight of our machine would hold it from going backward, while the same force of the wind which tends to push sidewise would in this case act as direct lift and also tend to pull the machine forward, and by proper handling we could stay in the air and travel in any direction without much loss of altitude the same as the soaring bird.

The flight of the soaring birds can be successfully imitated by man, as mentioned before, if my opinion that the act of soaring is simple rather than complicated, but we must have a machine in which many of the following features are essential if not quite indispensable:

First: A machine of very low resistance.

Second: A machine of not more than 1½ pounds to the square foot, loading, and, of course, the lighter the better.

Third: Wings must shift fore and aft at will of pilot.

Fourth: A variable angle of incidence controlled by pilot.

Fifth: A variable angle of incidence in either wing independent of the other, controlled by the pilot.

Sixth: Ample elevating surface in conjunction with fore and aft shift of wings, controlled by pilot.

Seventh: Ample rudder surface.

Eighth: Ample lateral balancing surfaces.

These last three for safety if nothing else, although the lateral balance will be taken care of in a machine having the variable angle as mentioned in fifth item.

Ninth: A heavy top and bottom bird-like camber which dies out towards the wing tips and, if possible, a flexible trailing edge.

Tenth: Fore and aft shift of pilot's weight.

All the above seems to call for a great deal of complication, but I think a design is possible that will make all this very simple and with very few moving parts.

In 1914 I started the construction of a soaring plane which was to embody some of the above features, but had to defer it owing to the war.

A Light Aeroplane Club Proposed for Young Men of Cleveland

Believing that it is "up to someone to do something" to arouse the interest of the people in Cleveland in aeronautics, Mr. Edward T. Purchase, 1983 Moltke St., Cleveland, Ohio, proposes the organization of an "Aeroplanette" Club such as suggested in *Aerial Age* by Mr. C. S. Parker of New York City.

Mr. Purchase declares that aeroplanes and aeronautics in general would be helped if a group of young men in Cleveland got together and interested themselves in the development of motorcycle engine planes and Ford engine planes. He suggests the formation of a club beginning with about twenty members over 16 years of age, and anyone wishing to join is invited to write Mr. Purchase at his home, enclosing a stamped self-addressed envelope for reply. As he has already undertaken the construction of a small training aeroplane or "grass cutter" of his own design, and has several designs to suggest to prospective members, there is every assurance that those who join will have a good deal to interest them at the start and that an association of young enthusiasts such as proposed should attract favorable attention in the region of Cleveland.

A-E-R-O-N-I-T-I-S

The Brave Aviators

High up in the atmosphere,
They sail on wings without fear.
High up in the chilly air,
They take risks that do and dare.

* * *

The wide expanse is their home,
There they love on wings to roam.
The humming motor and whistling wind,
Is their music when voice is dinned.

* * *

They know that it is as safe
To fly as riding on a wave.
They know the dangers of air stunts
Are as flying in the teeth of guns.

* * *

Why do they then stunt you say!
They do so to blaze the way.
And show how safe flying is,
And clear away man's prejudice.

* * *

The world seems slow to take to wings,
So the brave Aviator thinks.
He'll show the world by doing stunts,
Knowing oft how the story runs.

* * *

And when one dies who's to blame?
It was to advance the game.
They take it like Gladiators,
One by One the Brave AVIATORS.
—*H. Theo. Haller, Los Angeles, Cal.*

The Wrong Setting

The candelabra glowed a glare
Upon her soft, elusive hair
And shone profound affection where........
They sat.

The lad requested but one kiss
From the aforesaid little miss.
"Now don't refuse," he said, "for this........
Or that."

"By these little lights above you
I adore you, little dove, you."
She replied, "I cannot love you........
Here."

Damn Personal

By Seethat Jerdont

"When the frost is on the punkin,
And the corn is in the shock
The maids get out their lipsticks
And men redeem their tucks from hock."
—*Old Song.*

One on Collier

GEOLOGY PROF: Please give us the name of the largest diamond.

STUDE (the morning after the night before): The ace, doctor.—*Tar Baby.*

"I'll raise you two," said the wealthy lady to the orphans.

A Toast

Here's to the man who wears his hat,
And wears his hat alone,
For many a man wears another man's hat
And says he is wearing his own.

"Why did they put Bob out of the game?"
"For holding."
"Oh, isn't that just like Bob?"—*Virginia Reel.*

"My father occupied the chair of applied physics at Cambridge."

"Dat's nuttin'; mine occupied the seat of applied electricity at Sing Sing."—*Voo Doo.*

Ode to Ten Bucks

Oh, sweet, elusive ten-buck bill,
Pray bide with me awhile;
I'll let thee go against my will,
I love your golden smile.

"Best friends must part," the poets say,
"But parting brings sweet sorrow!"
I'll let you go tonight and pray
For more of you tomorow.—*Punch Bowl.*

Why Not?

His arm, it slipped around her waist—
Why shouldn't it?
Her head, it dropped against his breast—
Why shouldn't it?
Her heart, it gave a tender sigh—
Why shouldn't it?
Her hat pin stuck him in the eye—
Why shouldn't it?
—*Siren.*

"What is a pessimist?"

"He's a guy that complains because his bank roll is so thick that it breaks the stitches of his wallet."—*Punch Bowl.*

MOTHER: Share this apple with your sister, Willie. Show a Christian spirit.

WILLIE: Whadda yuh mean—a—Christian spirit?

MOTHER: Take a small bite yourself, and give Flossie the rest.

WILLIE: After you, Floss.—*Allt for Alla* (Stockholm).

Our Text-Book Age

"If I only knew what to do with baby!"

"Didn't you get a book of instruction with it, mother?"—*Kaper* (Stockholm).

Three Up—One to Go

"I hardly know how to decide this case."

"Well, Judge, there are two sides to every question."

"This is a triangle."—*Louisville Courier-Journal.*

VOICE OVER 'PHONE: I can't sleep, doctor. Can you do anything for me?

DOCTOR: Hold the wire and I'll sing you a lullaby!—*Passing Show* (London).

At Last

BURGLARS One sound from you and I'll squeeze you to death!"

ANTIQUE MAID: "Remember, that's a promise."
—*Washington Sun Dodger.*

A Kind Boss

PILOT: "I'd like to get marired but I can't support a wife on my present salary."

KIND BOSS: "All right, my boy, I'll give you a raise. But don't say afterwards that I did you no favor."—*Louisville Courier-Journal.*

The rookie stood on the railroad track—
The engine gave a squeal;
The fireman stepped down from the cab
And scraped him from the wheel.—*Idaho Yarn.*

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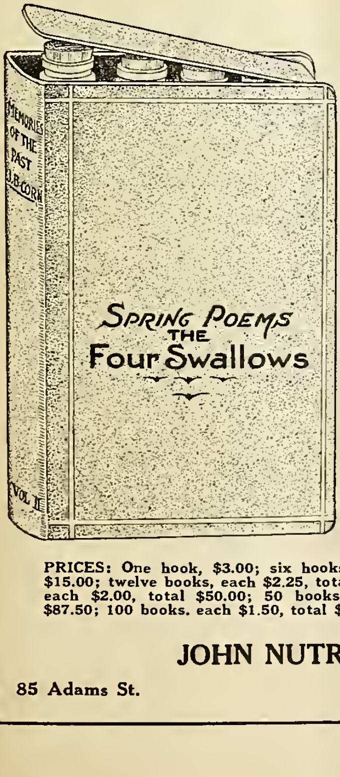

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JOHN NUTRY

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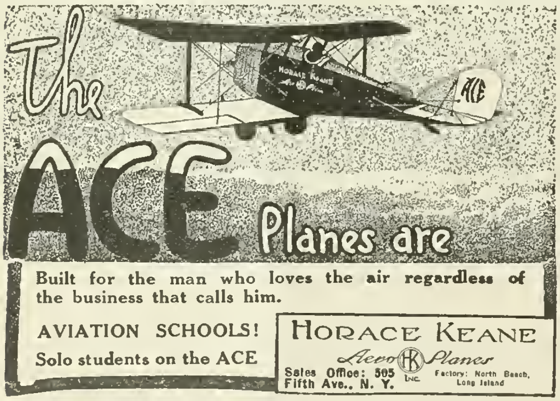

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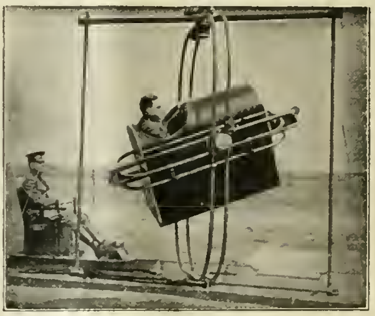

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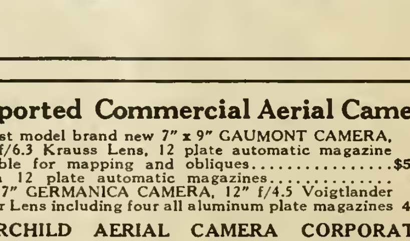

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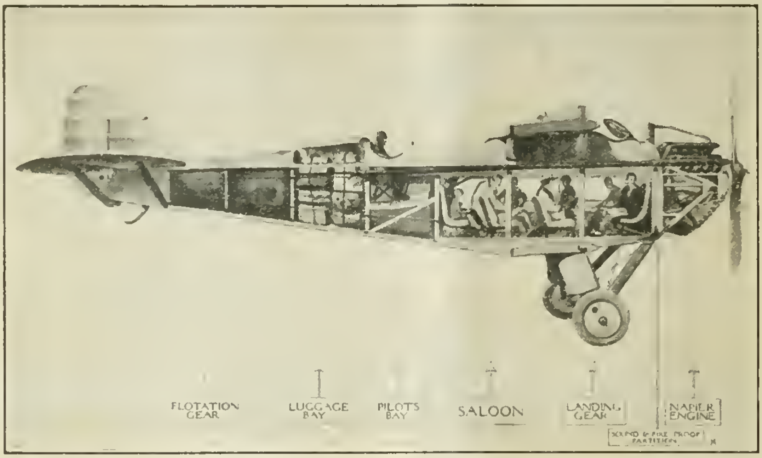

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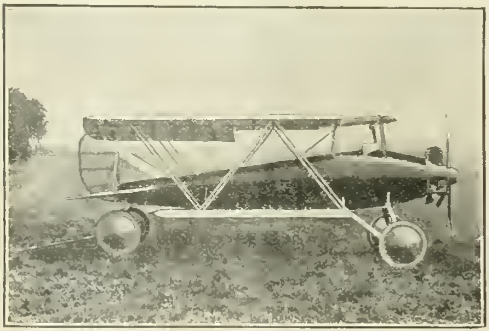

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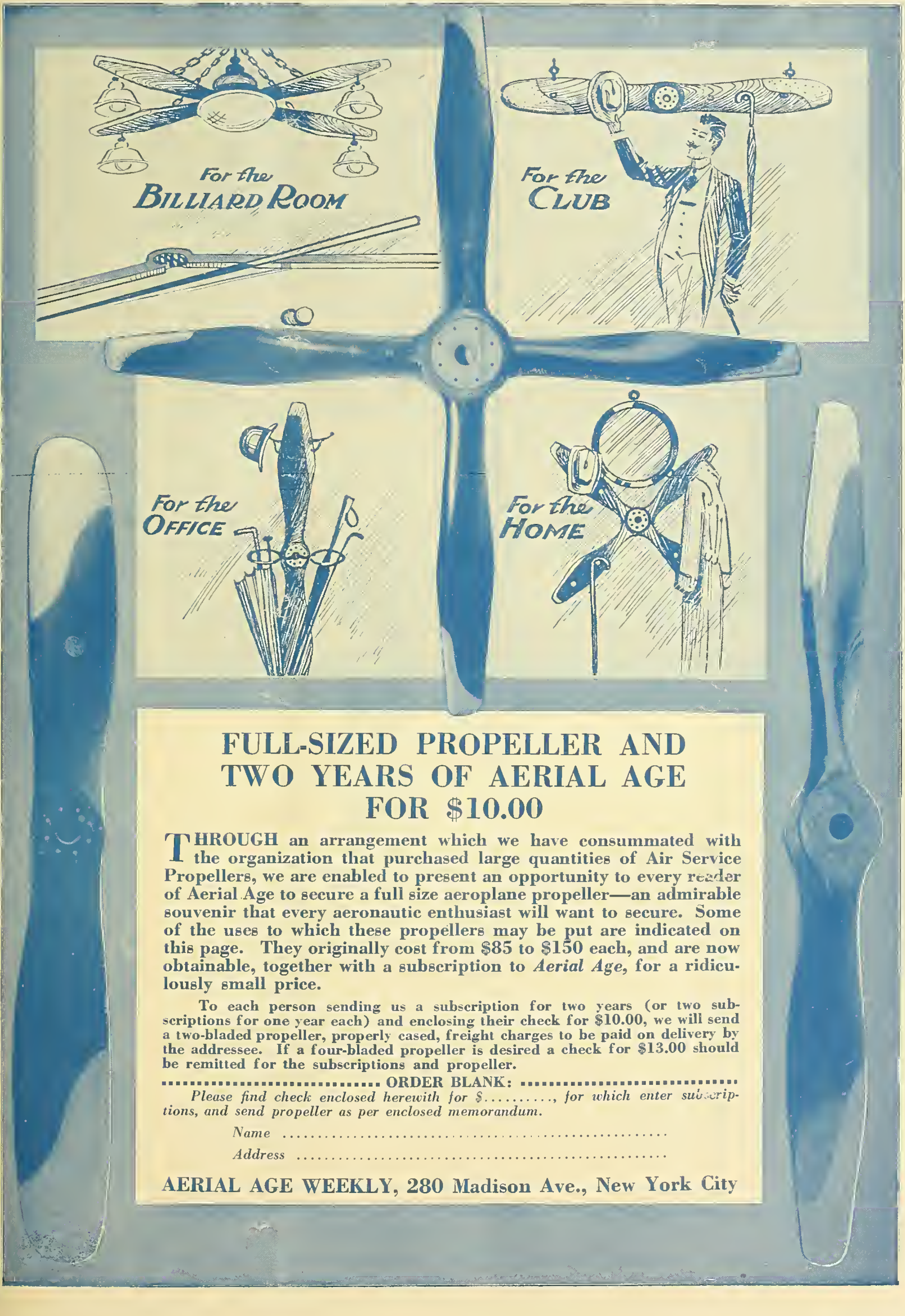

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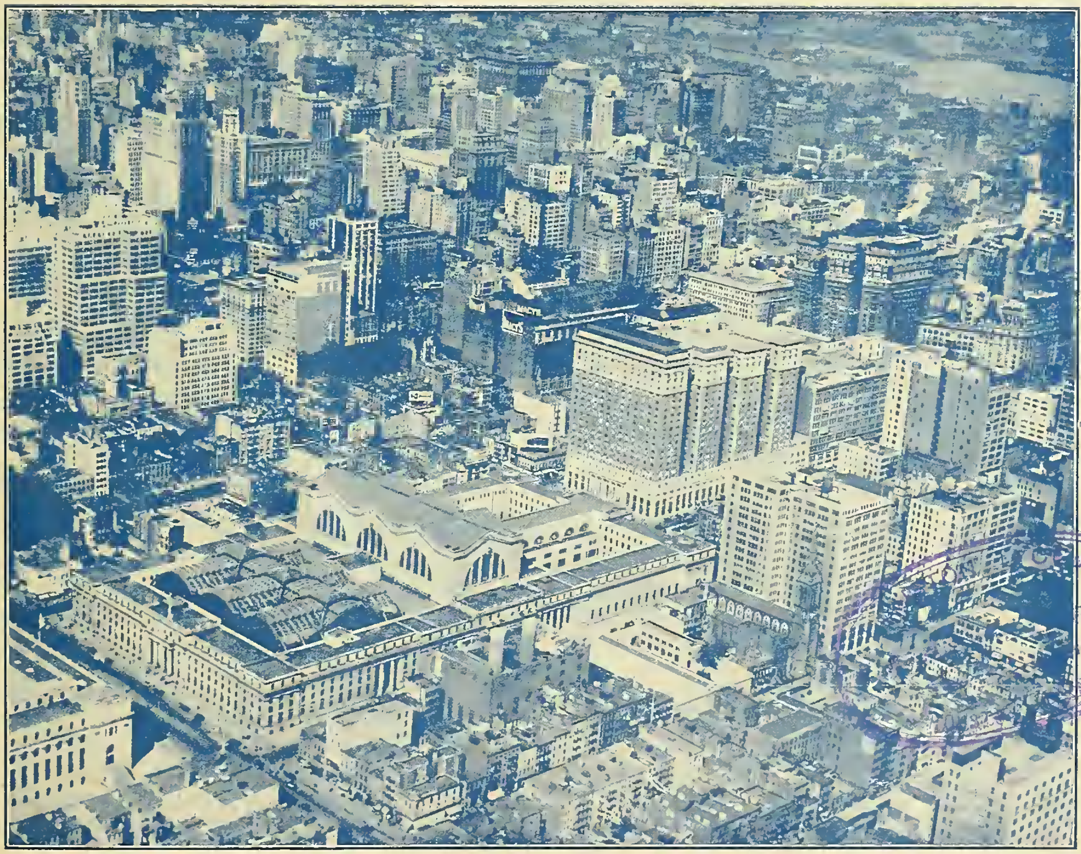

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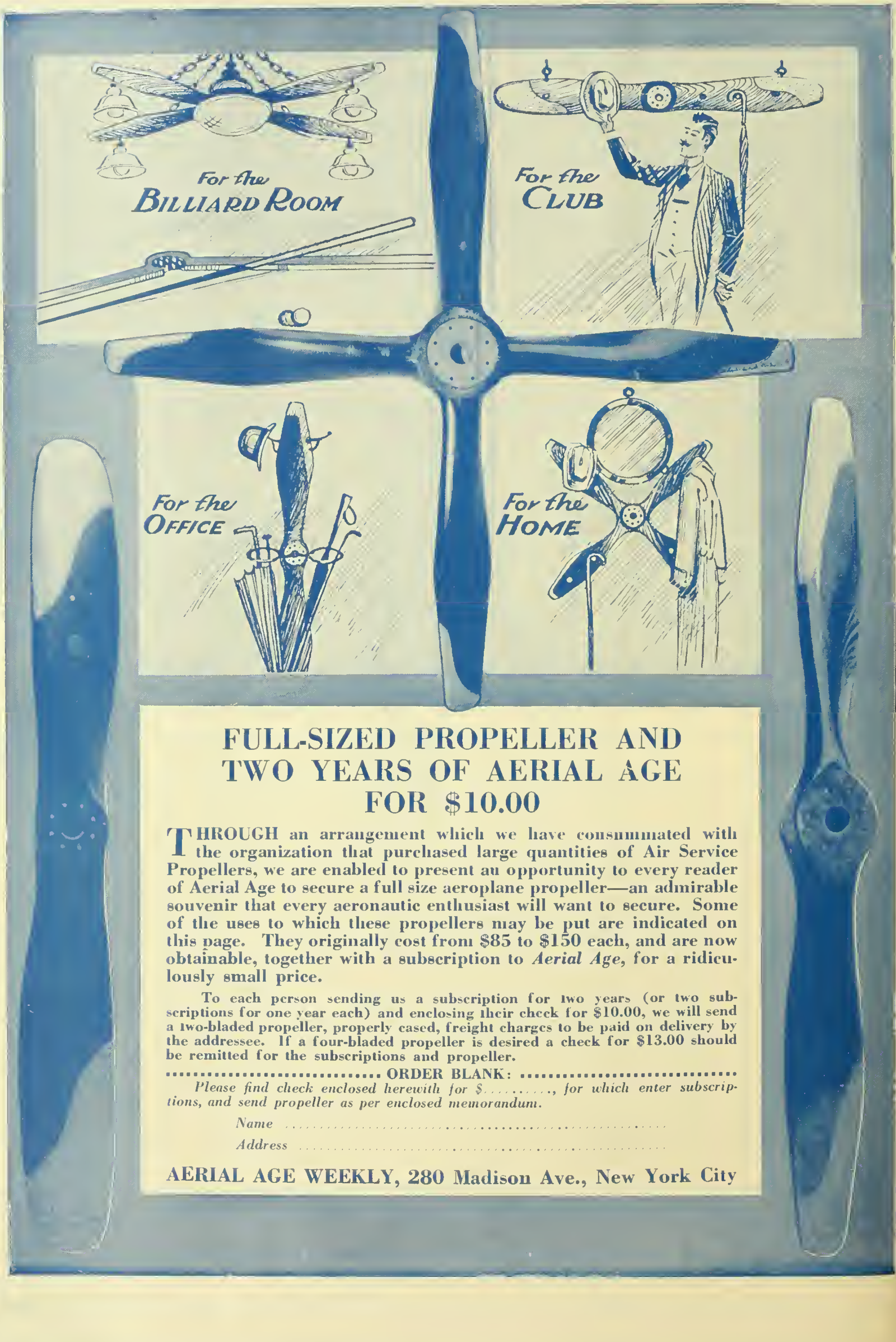

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This Pilot says:
"I have flown the Lincoln Standard over four States and consider it the best ship on the market. Its ability in tight places is wonderful."

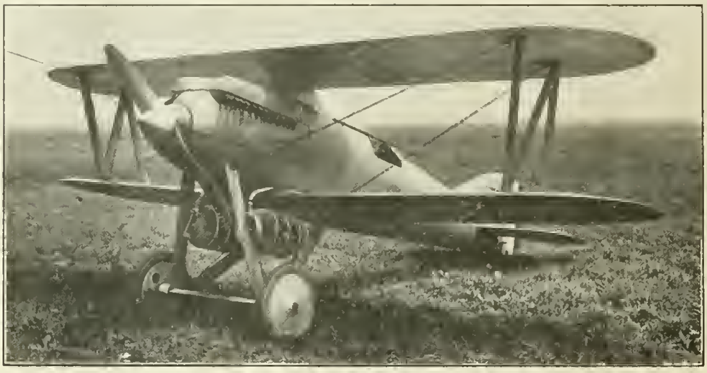
Price $3985
F. O. B. Factory

Ted LeCocq, Pilot (at left)
D. Swanson, Mechanic
Flying Lincoln Standard Speedster

"Man-O-War"
Owned by Mr. Collins of
Collins Oil Co., Knoxville, Ia.

NEBRASKA AIRCRAFT CORP.
Lincoln, Nebraska

Curtiss



WORLD'S RECORD

"CURTISS" NAVY RACER with "CURTISS" CD-12 MOTOR

AMERICAN LEGION CONVENTION, Kansas City
INTERNATIONAL AERO CONGRESS, Omaha
October 31st to November 5th, 1921.

"CURTISS" Firsts — LEGION JUNIOR DERBY—Casey Jones in "C-6 ORIOLE."
LEGION FREE-FOR-ALL—Lloyd Bertaud in "K-12 BALILLA."
PULITZER TROPHY RACE—Bert Acosta in "CURTISS NAVY RACER."
OMAHA 90-MILE RACE—Casey Jones in "C-6 ORIOLE."
OMAHA 75-MILE RACE—F. A. Donaldson in "OX-5 ORIOLE."

"CURTISS" Seconds—PULITZER TROPHY RACE—Clarence Coombs in "CURTISS COX RACER."
OMAHA 90-MILE RACE—N. C. Torstensen in "K-6 ORIOLE."
OMAHA 75-MILE RACE—Casey Jones in "OX-5 ORIOLE."

"CURTISS" Thirds — OMAHA 90-MILE RACE—R. S. Miller in "K-6 ORIOLE."

CURTISS AEROPLANE & MOTOR CORPORATION
GARDEN CITY LONG ISLAND, N. Y.

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With which is consolidated

Flying

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VOL. XIV NEW YORK, DECEMBER 26, 1921 No. 16

The Need for an Aeronautic Chamber of Commerce

ELSEWHERE in this issue we publish in full the bill introduced simultaneously in the Senate and House by Senator Wadsworth and Congressman Hicks, which indicates that at last a definite and concerted movement has been started to give the United States something like a national policy so far as civil aeronautics is concerned. In order that we may be in a position to accept all the benefits that come when this Bill is enacted into law, it behooves the aeronautic industry to get its house in order for the new regime, and the important ground work in this direction can best be done through an efficient Aeronautic Chamber of Commerce. In such a Chamber, including in its membership every aeronautic company in America, the Commissioner of Civilian Aeronautics would have a completely representative body to deal with, and this in turn would eliminate all log-rolling and delay, and would in the shortest time possible make available to the entire country all the benefits that will come from the proposed Bureau of Civil Aviation in the Department of Commerce.

Naval Aviation Progress

THE report of Admiral Moffatt, Chief of the Bureau of Aeronautics of the Navy, shows commendable progress for the past year in this branch of the nation's defenses. Perhaps the most outstanding fact in the report is the statement that naval and marine aircraft flew, during the fiscal year, a total of 2,511,055 miles. The notable flights of the year were those of the Atlantic and Pacific fleet air forces to the Panama Canal and return, the F-5L flying boats from Coco Solo, Canal Zone, to Cartagena, Colombia, and the Marine Corps' flight from Washington, D. C. to Santo Domingo City and return.

The question of developing a means for launching planes from battleships has apparently been successfully solved, and it will now be possible to provide all ships of the fleet with fighting planes as an answer to the menace of bombing aircraft.

The helium plant at Fort Worth, Texas has been placed on a production basis, and recently we referred to the success of the flight of the dirigible C-7, inflated with this gas.

Progress has been made in the photographic department, and during the year a photographic map of the Mississippi Delta was prepared for the Coast and Geodetic Survey and a map of Guantanamo Bay for the Hydrographic Office.

Excellent progress has also been made in the communication by wireless between aircraft and surface vessels.

Altogether the report of the Bureau of Aeronautics is most encouraging.

Eighteen Years of Wings

THE world of the late eighteen-nineties would have read with amused skepticism a prophecy that any such statement as Orville Wright issued yesterday would appear in December, 1921. The statement has appeared, and the world is not particularly excited. It is likely to forget in the moment of achievement, the stupendous nature of what has been achieved.

Yet there can be no doubt, to-day, eighteen years after the first flight in a heavier-than air machine, that the world has gone beyond most of its early dreams of human power to soar. The magic carpet of the Arabian Nights, the roc, Venus's sparrows, and Daedalus's wings are crude instrumentalities beside the N. C.'s, the ten passenger flying boats that ply between Key West and Havana, or the Curtiss navy racer that recently flew hundreds of miles at a league a minute. Venus and Icarus flew precariously through the open air, exposed to wind and sun. The modern passenger sits in a limousine interior and scans his paper, dozes, or contemplates the fading earth through windows.

We are less appreciative of what we have achieved because in achievement it has been dissociated from dreams and become associated with work and dollars. Tennyson's prophecy of the flyer harrying his enemy or "dropping down with costly bales" has proved a literal one. We carry the mail by air from New York to San Francisco, and we go faster than the fastest known winds, but we talk of pressure feed systems, fireproof dopes, super-charges, and stream-line fuselages instead of magic pinions and purple twilights. Flying is coming in like a lion—that is to say, like a standardized high-powered automobile or a Twentieth Century locomotive.

It was bound to be so, and it will be more so in the future. We need not be the less appreciative of flying on that account. What the world has never seems as wonderful as what it wanted, but a candid inventory of advantages usually proves that it is. If we do not get from the steamship, the railroad and the aeroplane all we dreamed of much of the fault lies with us. The machines do more than we asked. The disappointment and disillusion, where they exist, can too often be traced to our use of them.—*Editorial in N. Y. Globe.*

THE NEWS OF THE WEEK

Curtiss Wins Suit

The claim advanced by Glenn H. Curtiss that he he was the first to build a flying machine that could rise from and alight on the water, in seeking to establish his right to a broad patent on the hydroaeroplane, was upheld December 15 in a decision by the United States Circuit Court of Appeals of the Second District, and which reverses the decision of the United States District Court of the Eastern District of New York in the case of the Curtiss Aeroplane and Motor Corporation and Glenn H. Curtiss against Albert S. Janin and the Janin Company, Inc. The decision, signed by Judge Charles M. Hough, Martin T. Manton and Julius M. Mayer, constitutes the final chapter, at least in this jurisdiction, of one of the longest legal controversies ever waged in this country over the development of flying machines. At the offices of the Curtiss Company it was explained that the decision could not be appealed in this judicial district.

The prolonged legal controversy grew out of an application for a patent filed on Aug. 22, 1911, by Mr. Curtiss who, on Jan. 26 preceding, had demonstrated his flying boat in the harbor of San Diego, Cal. His successful flight with an air machine equipped with a boat hull structure and wings buoyed with small pontoons was made on the same day that Janin filed his application for what he described as a land, water and air machine.

The opinion of the court, written by Judge Hough, holds that when Curtiss made the San Diego flight he then succeeded in reducing to practice the theory of his invention, which entitled him to the broad patent thereon inasmuch as Janin's invention, at the time of this flight, and even later when the application of Curtiss was filed, had not advanced beyond the theoretical stage where it was described on paper, and that the mere description did not constitute a reduction to practice since it was never proved, and was unlikely to be proved, that Janin's plans would enable another person to build a hydro-aeroplane that would work with success.

"In this case," reads the opinion, "we feel sure that defendant's constructive reduction to practice received no assistance from any previous conception on his part; and this is true even if full credence be given to defendant's evidence as to his early drawings, models and experiments and no weight be attached to plaintiff's testimony tending to show Janin as one unworthy of belief.

"The reason for this holding is that whatever Janin conceived prior to Jan. 26th, 1911, whatever experiments or models he made, it is admitted that the ripe fruit of all that he had done was contained in the specification he then filed. If, therefore, that specification does not enable the man skilled in the art to construct without further exercise of the inventive faculty an operative hydro-aeroplane there has been no reduction to practice, constructive or otherwise.

"Janin disclosed no boat body, by his own evidence he never conceived a boat body other than one like that of a swift small vessel (e. g., a torpedo boat). He speaks even in his 1913 specifications only of a 'hull-like body,' and his drawings only reveal the freeboard of something long and narrow of historic boat shape."

The San Diego flight made by the Curtiss hydro-aeroplane was made possible by his development of the boat body with wing pontoons at his plant at Hammondsport, N. Y., where he was working on the water machine as early as 1910, when he flew from Albany down the Hudson to Governor's Island, alighting on land with an aircraft equipped with the floating appurtenances to alight in the river. The flight down the Hudson was witnessed by thousands along Riverside Drive and from the office buildings affording a view of the waterfront.

A technical discussion of the Court decision will be presented in the next issue of AERIAL AGE.

Gen. Mitchell to Fly 4,000 Miles in Europe

Brig.-Gen. William Mitchell, assistant chief of the air service of the army, left New York recently for a journey of 4,000 miles in Europe, most of which he expects to cover by aeroplane. The General was at the Aero Club of America and, according to Maurice Cleary, a governor of the club, he has been directed by the War Department to investigate and report on the development of military and commercial aviation in France, Holand, Germany and Italy.

Mr. Cleary said we had much to learn from European countries, and it was understood that Gen. Mitchell expected to collect information about the designs and construction of new types of machines and the organization and operation of commercial lines.

Contenders for the Collier Trophy

Contenders for the Collier Trophy should present their claims in writing to the "Collier Trophy Committee, Aero Club of America, 11 E. 38th St., New York City," before Saturday, January 7, 1922, as the award of this Trophy will be announced at the 14th Annual Banquet of the Aero Club of America, January 9, 1922.

This bronze trophy, to be known as the "Aero Club of America Trophy," was presented by Robert J. Collier, Esq. The trophy is to be awarded annually for the greatest achievement in aviation in America, the value of which has been thoroughly demonstrated by use during the preceding year.

The first award was given to Glenn H. Curtiss for his development and demonstration of the hydroaeroplane during the year 1911.

The trophy for the year was again awarded to Glenn H. Curtiss for his development and thorough demonstration of the flying boat, in which buoyance is supplied by the fuselage.

In 1913 the trophy was awarded to Orville Wright in recognition of the development and demonstration of his automatic stabilizer.

For 1914 the trophy was awarded to Mr. Elmer A. Sperry for his work in achieving the automatic control of an aeroplane by means of the gyroscope.

The trophy for the year 1915 was awarded to Mr. W. Starling Burgess, of Marblehead, Mass., in recognition of his development and demonstration of the Burgess-Dunne hydroaeroplane during the year 1915.

The trophy for 1916 was awarded to Mr. Elner A. Sperry for the development and thorough demonstration of the Sperry Drift Set.

CALENDAR OF COMING EVENTS
under saction of
AERO CLUB OF AMERICA

Annual Banquet Aero Club of America
Hotel Commodore, New York City,
7:30 Monday Evening, January 9, 1922
For members (who are entitled to bring guests) of
Aero Club of America, and affiliated Aero Clubs
Society of Automotive Engineers
Automobile Club of America
Automobile Club of New York
Motor Boat Club of America
New York Yacht Club
Tickets: $8.00

April 30th (1 or 2 days)
Spring Sbow and Opening Meet
Place: Curtiss Field, Mineola, L. I., N. Y.
Conducted by: Curtiss Airplane & Motor Corporation, Garden City, L. I.

September 4th (about) 1-day meet for
Detroit Aerial Water Derby
Curtiss Marine Trophy
Class Race Prizes
Invitation Races
Speed Trophy
Place: Detroit River and Lake St. Clair.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

September 15th (about) 3-day meet
Pulitzer Trophy
Detroit Aerial Derby
for Aviation Country Club of Detroit Trophy and Liberty Engine Builders' Trophy and Class Race Prizes
Invitation Races
Detroit News Aerial Mail Trophy
for Multimotored Aeroplanes Speed Trials
Place: Mt. Clemons Field, Detroit, Mich.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

August 15th (about)
In Preparation by the Aero Club of America
American Elimination Trials, if Necessary for La Coupe Deutsch de la Meurthe (Race to be held in France about October 1st. Place: Mitchel Field, Mineola, L. I., N. Y.

September 30th
First Annual Interservice Championship Meet
Open to the personnel of
The U. S. Army, Navy and Marine Corps Air Service
Championships in Single Seater Fighting Bombing Reconnaissance Races Photography Races Formation Flying, Etc.
Location: Mitchel Field, L. I., N. Y.

August 1st (about)
Foreign Events
Coupe Jacques Schneider
Contest for Flying Boats and Seaplanes
Place: Italy (probably Venice).
Conducted by: Aero Club d'Itali, 24 Via Tor de'Specchi, Rome.
American entries received by the Aero Club of America.

October 1st (about)
Coupe Henry Deutsche De La Meurthe Race for Aeroplanes
Place: France.
Conducted by: Aero Club of France, 35 Rue François-1, Paris.
American entries received by the Aero Club of America.

The AIRCRAFT TRADE REVIEW

U. S. Liberty 4 Engine

Spokane.—A new aerial motor, known as the "U. S. Liberty 4," has been designed, built and developed in Spokane by officials of the United States Aircraft Corporation, according to C. H. Messer, president of the concern. The engine has been given 50 hours in the air under difficult flying conditions, and is claimed to be an improvement over other types of engines in use here.

Through the engineering force of the aircraft company, the weight of the motor has been reduced from 595 to 414 pounds, a difference of 180 pounds, and the speed of the motor has been increased from 1400 revolutions a minute to 1600.

Additional reliability has been given by changing from the high to low compression type of motor.

In the tests of the new motor it has been found that the gasoline consumption has been decreased from 10 gallons to 8 gallons per hour, and the oil consumption cut from four quarts to one and a half quarts per hour, Mr. Messer said.

"The new motor which we have developed and designed has many advantages over anything we have used previously," Mr. Messer said. "It is so much lighter that we are enabled to carry an additional passenger with perfect safety. Although before the change the four-cylinder motor would deliver but 100 horsepower, we now compute its power at 140 horsepower.

"This motor has been especially designed to meet the needs of the western country. The propeller has greater ground clearance, making landings in rough country more easily accomplished. The nose of the machine is lighter, and the machine climbs much more rapidly.

"The low compressor type, with higher speed, makes the motor especially adapted to crossing the mountains, as it functions equally well at high or low altitudes. It greatly increases the speed of our Standard JI ships.

"Lieutenant Mamer, chief pilot, has made a trip to Montana and returned with the U. S. motor, and climbed it as high as 12,000 feet to cross the mountains, and found it to function perfectly.

"We intend to equip our three ships with the motor as fast as additional ones can be built. We will then look into the market to determine the advisability of constructing more of them for others who desire them."

Echo of the Pulitzer Race

We are in receipt of the following letter from C. Roy Keys, manager of the Curtiss Aeroplane and Motor Corporation, which is self-explanatory.

"In one of your contemporaries, *The Aeroplane*, of London, as quoted in the Air Service News Letter of December 9, 1921, the editor made the following comment on Acosta's performance in the Racer: (This is copied exactly as the Air Service News Letter printed it).

"At first his speed was given as under 173 m. p. h. but as this was not a world's record it was no good to America, whose representatives remeasured the course a little longer which brought up the speed to the required figure. According to one American newspaper the Curtiss Navy Racer was fitted with O.C.D. 12,400 h.p. motor and crossed the starting line at more than 250 m.p.h. This seems a very fair and modest estimate for such a powerful 'airplane'."

"In the first place, Mr. Grey, the editor of *The Aeroplane*, always has been an unconstructive criticizer of everything that happens over here, and here plays upon the efficiency of some newspaper's typesetting department in making his caustic remark; also you know and we know that the measuring of the course at Omaha was done by members of the committee there, through, I presume, civil engineers. If some publications said that it was surveyed at the instigation of Curtiss officials, as they did, it was because of numerous facts—one of them being that at least thirty days prior to the meet, the writer had a conference with the Secretary of the Aero Club of Omaha, in which he discussed numerous things, among others the direction around the pylons that the race ought to be run and the fact that the course should be carefully surveyed, with some knowledge of the 1920 development in his mind; also that Mr. Bradley, of the Manufacturers Aircraft Association, who went to Omaha six or seven days before the race, was asked by the writer and by Mr. Russell to be sure that the Aero Club of Omaha had had the course surveyed and proper certificates from competent engineers as to its length. When the reports began to come in of the speed of 176.7 miles per hour, every newspaper practically that talked to the writer, asked if the course had been surveyed, and we were able to state that we had been advised very definitely that the course was surveyed, and finally, of course, were able to tell them the exact length of the course."

Instrument Guides Planes in Fog

Fog is the airman's most dangerous foe, says the London *Times*. The pilot flying in cloud or fog, when he can see neither land nor sky, has no actual consciousness of direction, nor is he able to gauge the poise of his machine. True, he has a compass on board, but the lateral movement and the banking, the changes from climb to descent and vice versa, are inimical to the accurate reading of a compass. The compass card, continually disturbed by these movements, swings backward and forward, with no consideration for the magnetic north or anything else. Sooner or later the pilot is being carried by the aeroplane he knows not where. This fact has never been better illustrated than when recently a flight of machines set out from Shotwick for Dublin, a distance of only 120 miles. Heavy fog and cloud were met. One of the airmen came down off the Scilly Isles. The remainder were never found.

A device to keep the pilot constantly informed in cloud and fog of the actual behavior of his machine has just been perfected. It is called the Reid control indicator. It analyses, by means of a series of small electric lights, every tendency and movement of the aeroplane to which it is attached. It tells the pilot the air speed of his machine, its rate of turn when turning, and whether the machine is correctly banked for its rate of turn, and also direction of sideslip. It demonstrates, moreover, the movement necessary to enable the pilot to regain lost equilibrium and maintain a straight course.

The instrument weighs rather less than four pounds. It is divided into three parts, an upper row of lamps controlled by a mercury device, a lower row controlled by a gyroscope, and an air speed indicator. If the airplane is turning the lamps in the lower row light up, beginning from the centre and working outward, and so indicating the direction of the turn. If the machine is sideslipping lighting is produced on the same principle in the upper row. The port or left hand lamps are red, the starboard or right are green. The centre lamp in both rows is white. If the two white lights remain constant the machine is on a straight course.

The air speed indicator is set in the centre of the instrument and between the rows of lamps. From it the pilot can tell whether he is climbing or descending, according to whether his speed decreases or increases.

The rotation of the gyroscope is effected by an air stream created by the flight of the aeroplane, impinging on the gyro-wheel, in which slots are cut. Under this air pressure the wheel spins at a rate of 6,000 revolutions a minute. The wheel seeks to maintain itself on a constant axis; in other words, gyroscopic action holds it in one vertical plane, and if the aeroplane turns out of that plane to right or left the wheel fights to maintain its position and automatically closes a series of electrical switches on one side or the other and the corresponding lamps in the bottom row on the indicator are lit, as explained above. The number so lit corresponds with the amount of the aeroplane's turning movement.

A mercury bubble device controls the lamps in the upper row, illuminating or extinguishing them according to the movements of the aeroplane out of and into the horizontal plane.

It is claimed that with the Reid control indicator there is no evolution that cannot be carried out by an airman in fog and cloud, and that it makes point to point flying entirely simple in thick weather.

Personal Par

Foster Russell, of the Foster Russell Aeroplane Company, Spokane, Washington, who is in the east looking over the latest types of commercial aircraft, recently flew in the Sport Farman from Philadelphia to Baltimore to attend the flying meet of the Baltimore Flying Club. Mr. Russell was very much pleased with his trip and also with the many types of new machines which were exhibited at Baltimore.

BILLS INTRODUCED IN SENATE AND HOUSE TO AID DEVELOPMENT OF CIVIL AVIATION

As we briefly reported last week Senator Underwood and Congressman Hicks have introduced identical bills to create a Bureau of Civil Aviation in the Department of Commerce, for the regulation and development of air navigation. This action concurs with the recommendations of the President contained in his special message on the subject of aviation, sent to Congress since the opening of the present session in transmitting the annual report of the National Advisory Committee for Aeronautics.

These bills as introduced have been perfected and agreed upon by all agencies directly concerned with aeronautics, and hearings are expected to be held at an early date. The measures provide for the appointment by the President of a Commissioner of Civil Aviation, who shall prepare rules and regulations for air navigation, including the issuance of licenses for aircraft, aviators, and air stations, and authorizes him to designate and lay out air routes and to study the possibilities for the development of civil aviation in all parts of the United States.

The bill in its present form is the result of conferences between the representatives of the Aero Club of America, the aircraft industry, and heads of the Army and Navy Air Services, the Weather Bureau, and the National Advisory Committee for Aeronautics, and it is understood that it will have the support of the Administration leaders in Congress.

Following is the bill introduced by Congressman Hicks on Dec. 9:

A Bill

To create a Bureau of Civil Aviation in the Department of Commerce, to encourage and regulate the operation of civil aircraft in interstate and foreign commerce, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

That there is hereby established in the Department of Commerce, under the jurisdiction of the Secretary thereof, a bureau to be known as Bureau of Civil Aviation.

Sec. 2. That a Commissioner of Civil Aviation shall be at the head of such bureau, who shall be appointed by the President, by and with the advice and consent of the Senate, who shall receive a salary of $7,500 per annum. There shall also be an assistant commissioner of such bureau, who likewise shall be appointed by the President, by and with the advice and consent of the Senate, who shall receive a salary of $5,000 per annum. The assistant commissioner shall perform such duties as may be prescribed by the commissioner or as may be required by law. There shall be also a chief clerk of said bureau and such other deputies, assistants, and employees as may be required from time to time and as may be authorized by law.

Sec. 3. That it shall be the duty of the Commissioner of Civil Aviation, in conformity with the provisions of this Act, to foster civil aviation in every way possible and to do all things necessary therefor, co-operating with all other established governmental agencies and taking advantage to the fullest degree possible of the facilities they can offer. This shall include the following duties:

(a) To inspect the design and construction and, if approved, to license the operation of civil aircraft, in order to safeguard life and property.

(b) To regulate the navigation and operation of civil aircraft through the establishment of aerial traffic rules and regulations, in order to safeguard life and property.

(c) To designate, approve, and lay out air routes.

(d) To establish and encourage the establishment of landing fields and air stations.

(e) To make recommendations to the Weather Bureau as to the necessary meteorological service.

(f) To study the possibilities for the development of civil aviation in the United States, and to collect and disseminate information in relation thereto.

(g) To investigate, record, and make public the causes of accidents in civil aviation.

(h) To exchange with foreign Governments, through existing commercial attachés, information pertaining to civil aviation.

(i) To operate such aircraft as the Secretary of Commerce may deem necessary, licensing, regulating, and controlling the operation of civil aircraft, and the establishment of air routes, landing fields, and air stations.

(j) To prescribe the manner of using air routes and to utilize air navigation facilities and appurtenances.

(k) To prepare and maintain a comprehensive survey and inventory of all industrial and civil aeronautical resources under the jurisdiction of the United States.

Sec. 4. That, subject to the approval of the Secretary of Commerce, and for the purpose of making effective the provisions of this Act, the Commissioner of Civil Aviation shall by regulation provide for—

(a) Licensing pilots and such other persons engaged in the navigation or operation of civil aircraft as may be required for the public safety, and upon good cause the suspension or provocation of such licenses.

(b) The registration, identification, inspection, certification, or licensing of all civil aircraft, and upon good cause the suspension or revocation of such licenses.

(c) The registration, identification, inspection, certification, or licensinng of all civil landing fields or air stations, and upon good cause the suspension or revocation of such licenses.

(d) The conditions under which civil aircraft may be used for carrying and transporting persons or property or for the operation of any civil aerial service whatsoever and the licensing of any such service.

(e) The prohibition of the navigation of civil aircraft over such areas as may be specified for military, naval, postal, or other purposes, either temporarily or permanently, and either absolutely or subject to such exemptions or conditions as may be prescribed.

Sec. 5. That all rules and regulations authorized under the provisions of this Act shall be formulated by the Commissioner of Civil Aviation in cooperation with other established governmental agencies concerned, and they shall then be recommended to the Secretary of Commerce, and upon the latter's approval such rules and regulations shall be promulgated by him and shall have the effect of law and be enforceable from the date of such promulgation unless otherwise provided therein. The Secretary of Commerce, upon similar recommendations, shall have the power to amend, alter, suspend, or revoke such rules and recommendations and to promulgate new rules and regulations from time to time.

Sec. 6. That, subject to the approval of the Secretary of Commerce, the Commissioner of Civil Aviation shall, with the concurrence of other departments of the Government concerned, establish the conditions under which persons may be carried and property imported and exported in civil aircraft from, into, or through the United States, its Territories and dependencies, and to prescribe the areas within which aircraft entering the United States, its Territories, and dependencies or the waters thereof, are to alight and the conditions to be complied with by such aircraft.

Sec. 7. That the word "aircraft" as employed in this Act shall embrace every type of flying machine, conveyance, or vehicle now known or hereafter invented, devised, or developed, whether or not used in the carriage or transportation of persons or property, or without persons or property, flown, operated, or navigated in or through the air, and that the term "civil aircraft" as employed in this Act shall embrace all forms of aircraft except those owned and operated by the Army and the Navy.

Sec. 8. That it shall be unlawful to fly or to navigate or operate any civil aircraft in violation of the provisions of this Act, or of any rule or regulation promulgated in conformity therewith, or to fly or to navigate or operate any civil aircraft in interstate or foreign commerce, or in, over, upon, or along or through navigable streams, rivers, or waters, or post roads or routes of the United States, or the air or atmosphere above the same, or in, over or through the District of Columbia, the Territories, dependencies, reservations, national parks, or over any place or building over which the United States has jurisdiction, or to maintain or operate any landing field or air station over which the Bureau of Civil Aviation may exercise jurisdiction except in conformity with the provisions of this Act and such rules and regulations as may be promulgated pursuant thereto.

Sec. 9. That any violation of the provisions of this Act, or of any rule or regulation promulgated in conformity therewith, shall be punishable by a fine not exceeding $1,000 or by imprisonment for a term not exceeding one year, or both.

Sec. 10. That the Commissioner of Civil Aviation and such deputies as he may designate shall have power to conduct hearings, to subpoena witnesses, send for documents and other papers, to administer oaths, and to take such testimony as may be necessary in determining the qualifications of individuals for licenses or registration certificates to operate aircraft, landing fields, or air stations, or in the suspension or revocation of such licenses or registration certificates, or to enable him or them to make effective any of the provisions of this Act or any rule or regulation promulgated in conformity therewith.

SEC. 11. That the Commissioner of Civil Aviation is authorized, subject to the approval of the Secretary of Commerce, to fix the fees and charges for such inspection, registration, and licensing authorized by this Act, which fees and charges shall be collected by the Commissioner of Civil Aviation and put into the Treasury of the United States to the credit of miscellaneous receipts.

SEC. 12. That for the purpose of encouraging the development of civil aviation in he United States, full cooperation shall be given by the Bureau of Civil Aviation to the owners or operators of civil aircraft, and that the Secretary of War, the Secretary of the Navy, the Secretary of the Treasury, the Postmaster General, and the Secretary of Commerce shall furnish to any owner or operator of civil aircraft landing on an air station or landing field under their respective jurisdictions aviation fuel, oil, supplies, and necessary machanical assistance of an emergency character, under such regulations as they may approve and promulgate for their respective services. The proceeds from such sales and assistance shall be deposited in the Treasury of the United States to the credit of the appropriations involved.

SEC. 13. That the Commissioner of Civil Aviation shall publish periodically a bulletin setting forth all licenses issued or revoked, together with field reports of all flying activities, accidents, and field and route data, under the control of the bureau.

SEC. 14. That the Commissioner of Civil Aviation shall annually, at the close of each fiscal year, make a report to the Secretary of Commerce, giving an account of all moneys received and disbursed by him and describing the work done by the bureau, and the Secretary of Commerce shall transmit such report to Congress with the annual report of the Department of Commerce.

SEC. 15. That the district courts of the United States shall have exclusive jurisdiction over all claims and controversies involving aircraft, landing fields, and air stations, their owners, lessees, charterers, and operators licensed hereunder, with the right of appeal as in other cases. The law and procedure to be applied in determining such claims or controversies wherever arising, whether on land, water, or in the air, shall conform as nearly as may be to the principles of law and procedure applied in cases of admiralty jurisdiction. The owners, lessees, charterers, and operators of such civil aircraft, landing fields, and air stations shall be entitled to the same measures of exoneration from the limitation of liability as are provided for the owners, lessees, charterers, and operators of vessels by section 4281 to 4286, both inclusive, of the Revised Statutes of the United States, section 18 of chapter 121 of the Act of Congress of June 26, 1884, and the Acts amendatory thereof and supplemental thereto; and the rules of the Supreme Court of the United States and of the inferior United States courts relating to limitation of vessel owner's liability as now in force or as may be hereafter promulgated shall be applicable to claims and controversies involving such aircraft, landing fields, and air stations, their owners, lessees, charterers, and operators.

SEC. 16. That all salaries provided herein and all expenses incurred under the provision of this Act shall be paid out of such money as may be appropriated therefor by Congress.

SEC. 17. That if any portion of this Act be declared invalid it shall not affect any of the other portions thereof, which other portions shall continue in full force and effect.

SEC. 18. That this act shall take effect from and after the date of its passage, and all Acts or parts of Acts inconsistent herewith are hereby repealed.

NAVAL AVIATION ACTIVITIES IN 1921

FOLLOWING are extracts from the annual report of the Chief of the Bureau of Aeronoutics of the Navy.

Naval aviation activities during the fiscal ended June 30, 1921, continued to be scattered throughout various offices of the different bureaus of the Navy Department. With the lack of a coordinating central office to handle aeronautical matters, conditions were especially trying in the endeavor to promote naval aviation. This condition continued until September 1, 1921, when the Bureau of Aeronautics was established in the Navy Department. Notwithstanding the trying conditions that have existed during the past year, progress has been made both in the development of types of planes and in general aeronautical research work. Some of the outstanding features of the year's work cover the following:

(a) Flights of the Atlantic and Pacific Fleet air forces to the Panama Canal and their return.

(b) The flight of F-5-L flying boats from Coco Solo, Canal Zone, to Cartagena, Colombia.

(c) Marine Corps flight from Washington, D. C., to Santo Domingo City and return.

(d) Bombing experiments conducted on the ex-battleships Indiana and Iowa, and on ex-German warships.

(e) Practical completion of the large rigid airship shed at Lakehurst, N. J., and advancement in the construction of the rigid airship ZR-1 at the naval aircraft factory.

(f) The completion of a competition for the design of planes suitable for use from battleships.

(g) The continued progress in fitting the U. S. S. Langley as an aircraft carrier.

(h) The practical completion of the U. S. S. Wright as a lighter and heavier than air tender for aircraft with the fleets.

(i) Mileage flown by naval and marine aircraft for fiscal year, 2,511,055 miles.

The value of naval aircraft to the fleets has been demonstrated in spotting gunfire, in scouting, and in bombing.

Last year radio communication between aircraft and surface vessels was very elementary. Development has been made during the past year so that it is now possible for an aeroplane to be in direct aero radio communication with land stations and surface craft for considerable distances and under adverse weather conditions.

Heavier-than-Air

The accomplishments of the fleet air forces have been particularly gratifying. Nine F-5-L flying boats of the Atlantic Fleet air force made the trip from Philadelphia to the Canal Zone and return. Twelve F-5-L flying boats of the Pacific Fleet air force flew from San Diego to the Canala Zone and return. The actual distance covered in the flights of these two detachments approximate 12,000 miles.

Other flights of note during the past year were those of two DH-4B aeroplanes by the Marine Corps, from Washington, D. C., to Santo Domingo City and return, and the flight of F-5-L flying boats from Coco Solo, Canal Zone, to Cartagena, Colombia. The marine flight covered a distance of approximately 5,400 miles and the flight from Coco Solo a distance of about 800 miles.

In addition to the torpedo instruction that has been given at Pensacola, Fla., and the training flights and firing of dummy torpedoes at San Diego, the Atlantic Fleet torpedo division has operated from Yorktown, Va., as a base, and has conducted experimental research work in firing actual as well as dummy torpedoes.

The air forces of each fleet are now composed of scouting, spotting, combat, torpedo and bombing, and kite balloon squadrons.

As a result of competition among the aircraft manufacturers of the United States a type of plane suitable for spotting work is being developed, the award having been made to the winner of this competition, the Dayton Wright Co., and they are now engaged in producing the first planes of this type. To date none have been delivered.

It was arranged by the Army and Navy to loan to contractors planes which had been built by them for the Pulitzer race for the purpose of entering them in the contractor's name and at his risk and expense. The race this year was won by a Navy plane loaned to a contractor in this manner, fitted with a 400-horsepower engine and showed a higher speed than the 600-horsepower plane which won the last year's race. This indicates very satisfactory progress in aeronautical design in the past year. The reliability of the planes taking part in the race was better than the year before but still leaves room for improvement.

The question of developing a means for launching planes from battleships while under way or at anchor, which would do away with the objections to the platforms now installed on the guns, has been undertaken and further development of the catapult, as originally suggested by Capt. W. I. Chambers, United States Navy, is in progress and appears to offer a solution to many of the difficulties encountered with the turret platforms.

The past year witnessed the successful completion of the new catapult design for launching aeroplanes or seaplanes from ships of the fleet. This catapult was a development of the catapult that was installed on the North Carolina class of vessels before the war, but has been refined and simplified and reduced to a small track rotating on a turntable base. Successful flights have been made with this catapult using standard service seaplanes.

The significance of the catapult development lies in the fact that it is now possible to provide ships of the fleet with fighting aeroplanes as an answer to the menace of bombing aircraft. The best defense from aerial bombs is considered to be the small fighting aeroplane which can be shot into the air at a moment's notice from a ship's catapult and sent aloft to shoot down the attacking bombers which will be necessarily slow and cumbersome weight carriers, and, as such, extremely vulnerable to attack by planes of the combat type.

Lighter-Than-Air

As a result of successful experiments carried out abroad in mooring rigid airships to a mast, such a mast has been erected at Lakehurst, N. J. The success of the mooring mast will facilitate practically and economically the handling and operation of airships and increase their field of usefulness, as the weather limitations attendant upon operation from sheds and the expense connected with the construction of these large sheds will be for the most part eliminated.

Exercises with kite balloons in the Atlantic and Pacific Fleets have been continued with a view to determining their usefulness and the methods of their employment in the fleet. A total of 1,253 flights have been made.

The helium plant at Fort Worth, Texas, has been placed on a production basis, and progress is being made in the development of the helium. A nonrigid airship of the C class is being inflated with helium at the naval air station, Hampton Roads, and a practical demonstration of the use of this gas will shortly be made. This will be the first airship that has ever operated with an inert gas.

Spotting and Control of Gunfire

Spotting and control of gunfire by aircraft has been continued in both the Atlantic and Pacific Fleets. In the Atlantic Fleet the spotting has been carried on from the F-5-L type flying boats and in the Pacific from the smaller ship-plane type of planes. Considerable progress has been made in this work, and the results obtained have been very satisfactory.

Photography

Two projects of a large nature during the year have been undertaken, namely, the construction of a photographic map of the Mississippi Delta, for the Coast and Geodetic Survey, and the photographic mapping of the naval reservation at Guantanamo Bay for the Hydrographic Office. Experimental work in connection with the rapid development of photographs, the actual development of photographs in planes, accurate and a standardized system of photographic mapping, have been undertaken with success.

The use of aerial photography in determining the results of gunfire has been undertaken and found of great assistance to the office of gunnery exercises in determining accurately the results of gunfire in target practice.

Eerology

Mutual arrangements for a systematic interchange of weather reports have been made between the Navy and the Weather Bureau. A service has been inaugurated in cooperation with the Weather Bureau and Naval Communications for broadcasting a special report for aviation and marine stations from Arlington, which covers the east coast of the United States and adjacent marine areas. A similar service has been agreed upon and is in the progress of preparation to cover the west coast, and also one to cover the Gulf of Mexico and central area of the United States.

Arrangements have been made permitting naval radio stations to transmit to neighboring naval air stations direct and to the Weather Bureau the weather reports received from ships at sea. Arrangements have also been made at Coco Solo to have ships entering and leaving the Canal Zone send back weather reports while within radio communication. Steps have been taken to arrange for a world meteorological broadcasting system by radio, but to date these have not been acted upon by the international communication conference.

Air Stations

A minimum number of air stations necessary for the proper training of personnel and operation of aircraft with the fleets has been maintained throughout the year. The following stations have been in operation: San Diego, Cal.; Hampton Roads, Va.; Anacostia, D. C.; Pensacola, Fla.; Lakehurst, N. J; Rockaway, Long Island. Outside the continental United States: Coco Solo, Canal Zone; Pearl Harbor, Hawaii. Stations under the Marine Corps: Quantico, Va.; Parris Island, S. C.; Port au Prince, Haiti; Santo Domingo, Dominican Republic, and Guam.

In the interests of economy the following stations have recently been closed: Rockaway, Long Island; Yorktown, Va.; Cape May, N. J., and the marine station at Parris Island, S. C. With the same object in view, actual operation of aircraft from Lakehurst, N. J., has been eliminated, and all lighter-than-air operations at Pensacola, Fla., have been discontinued. Considerable reduction in the operation of planes at the stations at Hampton Roads, Va., and Coco Solo, Canal Zone, has been effected.

Fleet Air Forces

The work accomplished by the Atlantic and Pacific Fleet air forces has been most satisfactory. The Pacific Fleet air force devoted itself chiefly to the development of the ship planes, i. e., those planes that operate from battleships, the perfecting of the doctrine and tactics to be used in spotting of gun fire, while at the same time their large flying boats have successfully accomplished a long flight to the Canal Zone and return.

The work of the Atlantic Fleet air force has been in the nature of scouting and the offensive side of aviation, long-distance overseas flights, the development of doctrine and tactics for offensive bombing. This force also has accomplished successfully a long flight from Philadelphia to Panama and return. Aside from the flying involved in these long flights by both the Atlantic and Pacific air forces, the following additional problems have been undertaken:

(a) The bombing of the Indiana to determine the percentage of hits.

(b) The bombing and sinking of the U-117 and the search and dummy bombing of the radio controlled battleship Iowa.

(c) The development of smoke screens.

(d) The development of targets for anti-aircraft fire.

(e) The perfection of a torpedo for use from aircraft.

(f) The development of communications and direction finding from aircraft.

During the year the Marine Corps has made 3,364 flights, totaling 4,681 hours, or 300,285 miles.

A flight of two DH-4 planes successfully completed the trip from Washington, D. C., to Santo Domingo City, Diminican Republic, and return in 46 hours and 17 minutes.

Approximately 2,421,055 miles were flown by heavier-than-air craft, and 90,000 miles by lighter-than-air craft, or a total of 2,511,055 miles, at air stations and with the Fleet Air Squadrons, for the fiscal year ended June 30, 1921.

Aeronautical Board

Valuable work in preventing duplication and in reconciling aviation problems between the Army and Navy has been accomplished during the year by this interdepartmental board.

The National Advisory Committee, in which the Navy is represented, has rendered during the past year valuable assistance in scientific and technical matters pertaining to aviation.

Bureau of Aeronautics

In accordance with an act of Congress, the Secretary of the Navy issued orders for the establishment of a Bureau of Aeronatics to begin operations September 1, 1921. The organization was begun on that date with Rear Admiral William A. Moffet as chief of the Bureau. The establishment of this bureau is a very encouraging and important action on the part of the Government and the Navy Department. Inasmuch as it gives opportunity for coordinating activities concerning all aeronautical problems coming under the jurisdiction of the Navy, it reduces lost motion to a minimum and brings about economy of operation with a reduction in overhead costs, and at the same time places the chief of the bureau on a par with the chiefs of other bureaus in the Secretary's council.

The Bureau of Aeronautics realizes that the Government should do everything practicable to encourage and to stabilize the aviation industry of the United States. It is well understood that the risk involved to private concerns of experimental development has worked a hardship. In so far as may be possible, the Naval Aircraft Factory will be employed for the prosecution of experimental development. Actual production at the factory will be almost negligible. The Bureau of Aeronautics desires not to compete with commercial concerns, but to cooperate with them.

7,000 Mile Trip by Air is Started.

Lucien Sharpe, of Providence, R. I., intends to capture the title of the world's greatest air passenger. Last September Mr. Sharpe, who is wealthy, was mistaken for a prominent New York banker when he undertook a mysterious trans-European air voyage.

Mr. Sharpe left Le Bourget, the flying just outside of Paris, Dec. 12, on a two months' air tour which will take him more than 7,000 miles. He refused to comment on his trip beyond declaring that the railroads are too slow and uncomfortable to satisfy him. He is accompanied by the same pilot—Cobham—whom he employed on his trip last September. He will visit Toulouse, Madrid, Casablanca, Dakar, Oran, Algiers, Tunis, Brindisi, Athens, Constantinople and Bucharest, returning to Paris by way of Belgrade, Budapest, Vienna, Munich and Strasbourg.

GROUND INFLUENCE ON AEROFOILS*

By ARTHUR E. RAYMOND
Massachusetts Institute of Technology

(*Technical Note of the National Advisory Committee for Aeronautics*)

THE work leading up to the preparatoin of this report was done as a thesis by the author while a student in the Aeronautical Engineering course at the Massachusetts Institute of Technology. He wishes to acknowledge the assistance in preparing models, conducting tests, and preparing the report for publication, of Mr. Carl Selig, mechanic of the Department of Physics, Mr. Boris V. Korvin Kroukovsky, and Professor E. P. Warner, of the Department of Physics.

The question of ground influence on aeroplanes has recently attracted some attention in view of the claims made by certain designers that the landing speed of their aeroplanes is much decreased by an increase in lift coefficient due to the proximity of the ground in landing. As an illustration of this, in the description of the Pischoff Avionette given in *Aviation* for January 25, 1921, the statement is made that "the proximity of the lower wing to the ground, eight inches, causes the air imprisoned between the wing and the ground to act as a cushion." (The chord of the lower wing of this aeroplane is 2 ft. 4 m.) It has also been suggested that the difficulty experienced in landing some aeroplanes with high-lift wings, and notably those models with flap gears, may be due to such an increase in lift coefficient when approaching the ground, causing the aeroplane to stay off the ground while travelling nearly parallel to it for an abnormal length of time. Several investigations, discussed in detail later, have previously been undertaken on this point.† There seems to be room for another particularly to try out the relative merits of two possible methods of making ground influence tests.

The method of testing which first suggests itself is to set up a flat plate in the tunnel to represent the ground. This was one of the methods employed but the results obtained by it are not entirely satisfactory. Its fault lies in the fact that it is stationary with respect to the aerofoil, not to the wind. It represents the case in practice where the aeroplane lands in a wind of as great a velocity as its own air speed. Such a condition is fortunately rare and it is doubtful if the flow of air across the landing field at such a time would approximate the flow around a flat plate in the wind tunnel.

A method giving results of more practical value was found in the reflection method. Considering the ground plane as a mirror in which the aerofoil to be tested is reflected in a duplicate aerofoil placed in the position of its image, two wings are placed symmetrically in the tunnel, with the ground plane considered as the plane of symmetry half way between them. Forces are read on one only and whenever the angle of attack of one is altered the angle of the other is changed correspondingly. The ground plane in this case being imaginary, no error is introduced on account of skin friction, as in the flat plate method. The reflection method was found to give two slightly different types of flow at high lift angles, due to disturbance of the plane of symmetrical air flow by vortices, but it is believed that the results show it to give a closer approximation to ground plane influence than does a flat plate.

All tests were made in the 4 ft. tunnel at the Massachusetts Institute of Technology. Wind velocity through the tunnel was in all but two tests 30 m.p.h. In an effort to obtain satisfactory readings on one of the wings at an angle of discontinuity the velocity was increased in these two tests to 40 and 45 m.p.h. The effort was successful but overheated the motor driving the tunnel propeller, and it was not attempted again.

The dimensions of the three models used were 3 in. by 18 in. The models were:

1. Martin No. 2. A thick section wing fitted with flap gear. The duplicate wings used were very accurately made and agree with the specified ordinates to within 2%.
2. R.A.F. 15 Special. A double-chambered moderately thin wing. The models used were old ones, both quite warped, but were placed in the tunnel warped in the same direction and were very nearly the same distance apart at all points along their span.
3. U.S.A. 27. These models were very inaccurately made and are not true U.S.A. 27 aerofoils, but served well enough for the purpose in hand.

Flat plate method. A piece of three-ply birch ⅜ in. thick, 4 ft. high, 3 ft. wide, was used. The leading edge was chamfered on the side way from the model. Small wooden strips were attached to the top and bottom and screwed to the ceiling and floor of the tunnel, maintaining the plywood flat and at the proper distance from the aerofoil.

Reflection method. The aerofoil to be tested was mounted on the spindle of the balance in the usuel way and the reflecting wing placed on a spindle mounted with a graduated head, on an auxiliary wooden fairing having a brass floor plate. After each reading the wind in the tunnel was shut down while the reflecting wing was shifted to its new angle of incidence. In all comparative tests the single wing was tested immediately before the reflecting wing was put in place.

For tests made at a fixed angle of incidence, with the wings

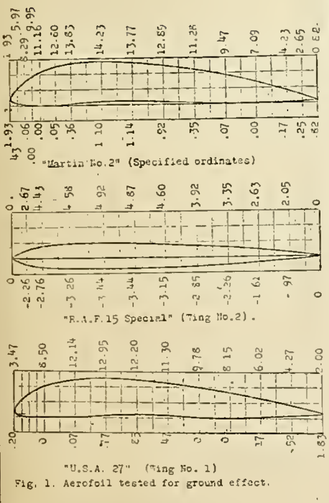

Fig. 1. Aerofoil tested for ground effect.

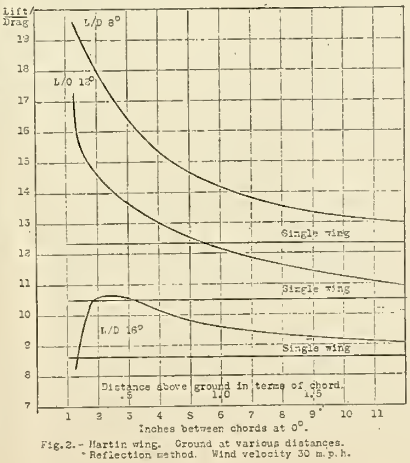

Fig. 2.- Martin wing. Ground at various distances. Reflection method. Wind velocity 30 m. p. h.

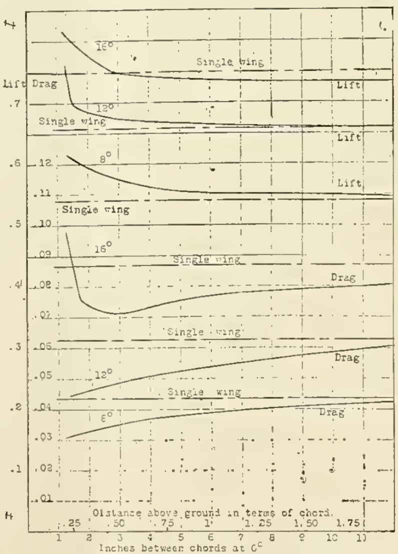

Fig. 3. Martin wing. Ground at varying distance. Reflection Method. Flaps neutral. Readings on Wing Wind velocity 30 m. p. h.

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* Submitted as a thesis in the graduate course in Aeronautical Engineering in 1921, and published by permission of the Department of Physics at the Massachusetts Institute of Technology.

† "Ground Effect on Wings," by A. A. Merrill, The Ace, December, 1920; "Ground Influence on Wings," by the Aerodynamics Staff, Report No. 173; "Wind Tunnel," Navy Yard, Washington, D. C.

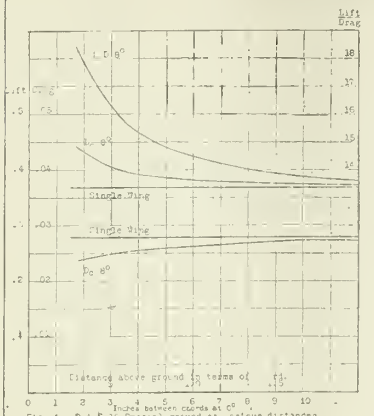


Fig. 4 - R.A.F. 15 Special ground at various distances Reflection method Wind velocity 30 m.p.h. Reading on Wing 2

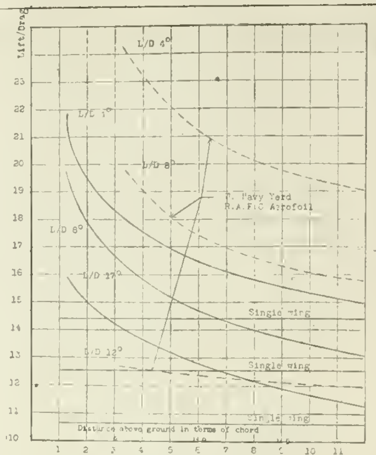


Fig. 5 U. S. A. 27. Ground at various distances Reflection Method Wind velocity at 30 m.p.h.

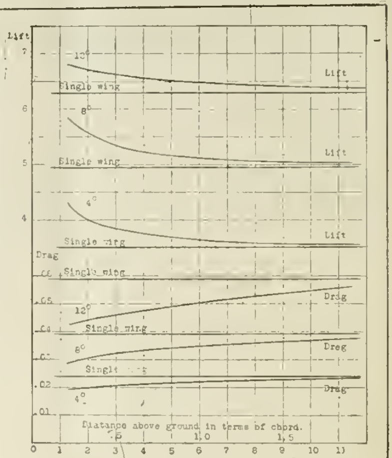


Fig. 6. U.S.A. 27. Ground at varying distance (Reflection Method) Readings on Wing 1. Wind velocity 30 m.p.h.

at a varying distance apart, the reflecting wing, its spindle, and graduated head were mounted on a brass rail running from the center fairing to a second fairing placed near the tunnel wall. This brass rail was graduated for distances between spindle centers of from 1.75 to 16.00 inches. It was found that the apparatus holding the reflecting wing caused no measurable influence upon the other wing.

In running a test at a fixed distance it was found best to keep the distance between spindles or from spindle to plywood constant. The wings being lined up at 0° before each test, the distance was measured from chord to chord at that angle and not from spindle to spindle. The position of the spindle (center of rotation) for each aerofoil is given below and a chart is appended for determining the distance between trailing edge and ground in each case:

	—Center of Rotation—	
Wing	*Back of L.E.*	*Above Chord*
Martin No. 2	1″	0.25″
R. A. F. 15 Special	1″	0.00″
U. S. A. 27	1″	0.20″

In plotting results, absolute coefficients are used throughout.

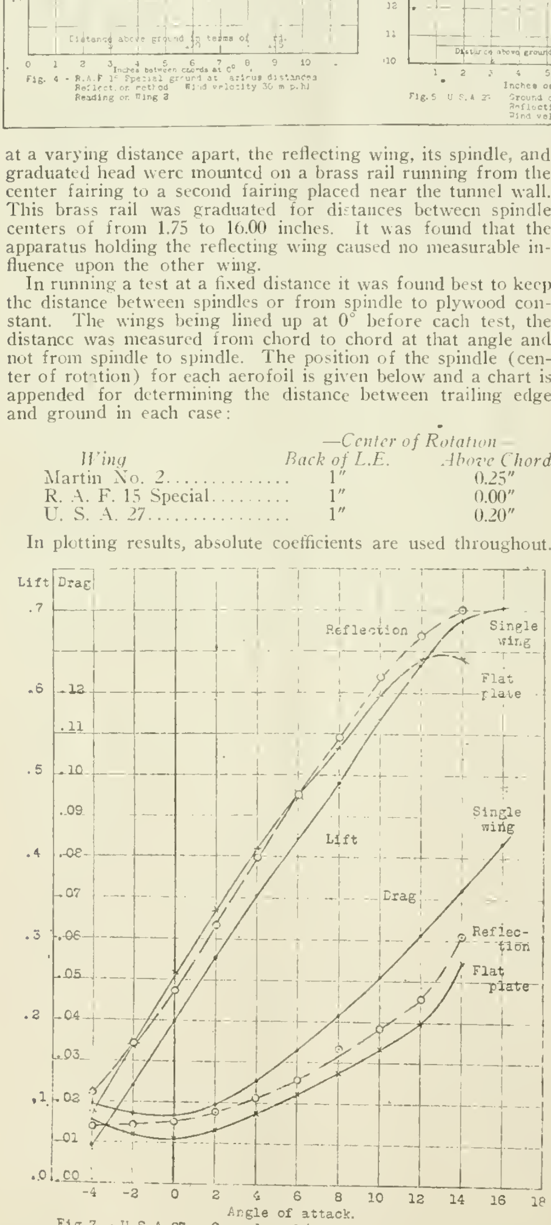


Fig. 7. - U.S.A. 27. Ground at 1/2 chord. Wind velocity 30 m.p.h.

Reading on Wing 1.

Reflection method. Considering first the tests made with the ground at ½ chord: The most marked effect is an increase in L/D of from 35% to 40% at angles ranging from —4° to maximum lift. This is caused by an increase in lift and a decrease in drag. The increase in lift is greatest at small angles, weakening perceptibly as the burble angle is approached. The decrease in drag, on the other hand, is most marked at high angles, the combined effect being an increase in L/D of substantially a constant percentage.

Maximum lift is increased little, if any, at ½ chord ground distance, but there is a tendency to shift it to a smaller angle.

The Martin wing (flap neutral) at 30 m.p.h. showed an increase in maximum lift at ½ chord, but at 40 and 45 m.p.h. this did not occur. While making tests at 14° and 16° at varying distance two types of flow were observed, which account for this on the supposition that the ground plane of symmetry is easily broken up at high angles and speeds by the intermingling of vortices from the two reflecting wings. If this be true, the type of flow which gives an increased lift is the one for which the vortices do not intermingle, and therefore corresponds to the ground influence felt by a full-size aeroplane.

Turning to the tests made at varying ground distances as given in Fig. 3, a noticeable fact is the speed with which the ground influence increases as the wing comes within 1.2 chord of the ground. The effect on lift is very slight at 2 chords, but that on drag is still considerable. The curves approach asymptotically the single wing values, as would be expected with the exception of the 16° lift curve, which for distances greater than ½ chord lies below this value. The single wing lift was checked carefully after the test and is correct.

The drag curve for this same test is also interesting. The sharp upward bend as the ground distance becomes less than half a chord is probably due to stoppage of the air flow, for the trailing edge of the wing at this angle and these distances are very close to the ground.

The diminution of effect on lift and increase of effect on drag with increasing angle for the U. S. A. 27 aerofoil is shown very nicely in Fig. 6.

(*Concluded on page* 376)

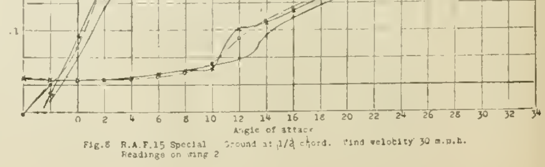


Fig. 8 R.A.F.15 Special Ground at 1/2 chord. Wind velocity 30 m.p.h. Readings on Wing 2

LANDING FIELDS IN CANADA

The following is a list of air harbors licensed by the Air Board of Ottawa, Canada, corrected to September 30, 1921:

Regina, Saskatchewan, *commercial air harbor.*—Situated southwestward of the city of Regina, Saskatchewan, near the Parliament Buildings. Latitude 50° 25′ N., longitude 104° 39′ W. Altitude 1,890 feet above sea level. Local magnetic variation 19° 02′ E. Maximum dimensions for landing—over 800 yards. Licensed for use by day only and marked with an equilateral triangle, each side of which is three feet wide and 25 feet long. See Diagram of Markings, Ref. No. 28.

Directional wind indicator on hangar. Telephone connection. Water and fuel supply. Hangar accommodation and facilities for minor repairs only. Available communication to city of Regina—electric railway, motor transport, good roads.

Licensee—Aerial Service Co., Box 285, Regina, Saskatchewan.

Saskatoon, Saskatchewan, *commercial air harbor.*—Situated 2 miles northwestward of Saskatoon Post Office. Latitude 52° 08′ N., longitude 106° 43′ W. Altitude 1,640 feet above sea level. Local magnetic variation 23° 05′ E. Maximum dimensions for landing 300 by 400 yards. Licensed for use by day only and marked with a triangle divided by two lines forming a cross into four approximately equal parts. See Diagram of Markings, Ref. No. 24.

Directional wind indicator on hangar. Telephone 5221. Telegraph and telegraphic address— McClelland Aircraft, 104 Cobbold Block, Saskatoon, Saskatchewan. Water and fuel supply. Facilities for repair to Curtiss J. N. 4 machines. Accommodation for one machine. Available communication to the city of Saskatoon. Motor transport, dirt roads.

Licensee.—McClelland Aircraft (Ltd.), 104 Cobbold Block, Saskatoon, Saskatchewan.

Edmonton, Alberta, *commercial air harbor.*—Situated on St. Albert Trail 3½ miles northwestward of Edmonton Post Office. Latitude 53° 35′ N., longitude 113° 33′ W. Altitude 2,215 feet above sea level. Local magnetic variation 27° 0′ E. Maximum dimensions for landing—under 300 yards. Licensed for use by day only and marked with a triangle divided by a cross into four approximately equal parts. See Diagram of Markings, Ref. No. 24.

Directional wind indicator on hangar. Telegraph and telegraphic address— May-Gorman Aeroplanes (Ltd.), 10327 Ninety-ninth Avenue, Edmonton, Alberta. Telephone connection. Water and fuel supply. Facilities for minor repairs only. Hangar accommodation. Available communication to city of Edmonton. Motor transport, electric railway ½ mile southeastward of aerodrome, good roads.

Licensee. — May - Gorman Aeroplanes (Ltd.), 10327 Ninety-ninth Avenue, Edmonton, Alberta.

Hanna, Alberta, *commercial air harbor.*—Situated ¾ mile southeastward of the town of Hanna, Alberta. Latitude 51° 38′ N., longitude 111° 56′ W. Altitude, 2,677 feet above sea level. Local magnetic variation, 24° 05′ E. Maximum dimensions for landing—under 300 yards. Licensed for use by day only and marked with a triangle divided by a cross into four approximately equal parts. See Diagram of Markings, Ref. No. 24.

Directional wind indicator on hangar. Telephone connection. Telegraph and telegraphic address—Holbrook & McLeod, Hanna, Alberta. Water and fuel supply. Facilities for minor repairs to Curtiss J. N. 4's. Accommodation for one machine. Available communication to town of Hanna—motor transport, good roads.

Licensee.—Holbrook & McLeod, Hanna, Alberta.

Montreal, Province of Quebec, *customs air harbor.*—Latitude 45° 30′ N., longitude 73° 40′ W., approximately 7 miles north of the city of Montreal, near the town of St. Laurent. Altitude, 140 feet above sea level. Local magnetic variation, 15° 35′ W. Dimensions, 750 yards north and south by 400 yards east and west. Licensed for use by day only and marked with double cross-barred square surrounding a circle. See Diagram of Markings, Ref. No. 20.

Customs personnel on duty only when notified at Montreal customhouse. Telephone, gasoline, oil, and water supplies are available and handling party is stationed on the aerodrome. There are two hangars in north end of aerodrome. Repairs can be carried out. A wind indicator is placed on northwest corner.

Communication.—Road, steam and electric railway.

Licensee. — Canadian Division of the Aerial League of the British Empire.

Operated by R. & W. Air Service.

Armour Heights, Ontario (near Toronto), *customs air harbor.*—Latitude 43° 43′ N., longitude 79° 24′ W., about 1½ miles northwestward of Stop 26, Metropolitan Railway, York Township, Ontario. Altitude, 540 feet above sea level. Local magnetic variation, 6° 40′ W. Dimensions, 400 yards in circular diameter. Licensed for use by day only and marked with a square and circle inserted, divided in equal parts by a vertical line. See Diagram of Markings, Ref. No. 21.

Customs personnel on duty only when notified at Toronto customhouse. Directional wind indicator in northeastern corner. Telephone connection and water supply. There are facilities for repairs, fuel supply and machine accommodations, and a handling party is stationed on the aerodrome.

Available communication to city—Electric railway, 1 mile from aerodrome. Good roads.

Licensee. — Bishop - Barker Aeroplanes (Ltd.), 93 Spadina Avenue, Toronto, Ontario.

Winnipeg, Manitoba (River Park), *commercial air harbor.*—Situated at River Park, western edge of the city of Winnipeg. Latitude 49° 51′ N., longitude 97° 08′ W. Altitude 760 feet above sea level. Local magnetic variation 12° 07′ E. Maximum dimensions for landing—under 300 yards. Licensed for use by day only and marked with a triangle divided by two straight lines forming a cross into four approximately equal parts. See Diagram of Markings, Ref. No. 24.

Directional wind indicator on hangar. Telephone connection. Telegraph and telegraphic address — Winnipeg Airco (Ltd.), 408 Confederation Life Building, Winnipeg, Manitoba. Water and fuel supply. Facilities for minor repairs only. Hangar accommodation. Available communication to city of Winnipeg—electric railway, motor transport, paved roads.

Licensee.—Winnipeg Airco (Ltd.), 408 Confederation Life Building, Winnipeg, Manitoba.

Winnipeg, Manitoba, *commercial air harbor.*—Situated 5 miles in a westerly direction from corner Portage Avenue and Main Street, Winnipeg. Latitude 49° 53′ N., longitude 97° 18′ W. Altitude 776 feet above sea level. Local magnetic variation 13° 0′ E. Maximum dimensions for landing—500 by 300 yards. Licensed for use by day only and marked with a triangle divided by two lines forming a cross into four approximately equal parts. See Diagram of Markings, Ref. No. 24.

Directional wind indicator on pole near hangar. Telephone N. 6415. Telegraph and telegraphic address Canadian Aircraft Co. (Ltd.), 43 Aikens Building, Winnipeg, Manitoba. Water and fuel supply. Facilities for repairs. Accommodation for two machines. Available communication to city of Winnipeg —electric railway, motor transport, paved roads.

Licensee. — Canadian Aircraft Co. (Ltd.), 43 Aikens Building, Winnipeg, Manitoba.

Lac a la Tortue, Province of Quebec, *commercial seaplane station.*—Situated ¼ mile east of Lac a la Tortue and 3 miles southeast of Grand Mere, Province of Quebec. Latitude 46° 36′ N., longitude 72° 40′ W. Altitude 430 feet above sea level. Local magnetic variation 18° 02′ W. Maximum dimensions for landing—over 800 yards. Licensed for use by day only and marked with an equilateral triangle each side of which is 3 feet wide and 25 feet long (inside measurement). See Diagram of Markings, Ref. No. 28.

Directional wind indicator on hangar. Telephone number 109 ring 31. Water and fuel supply. Facilities for minor repairs. Hangar accommodation. Handling partly stationed at air harbor. Available communication—good roads (sand), taxis to village.

Licensee.—Laurentide Co. (Ltd.), Grand Mere, Province of Quebec.

Virden, Manitoba, *customs air harbor.*—(Latitude 49° 50′ N., longitude 100° 50′ W.) about 1½ miles south of the town of Virden, Manitoba. Altitude, 1,450 feet above sea level. Local magnetic variation, 16° E. Dimensions, 800 yards north and south by 800 yards east and west. Licensed for use by day only and marked with a square and enclosed circle. See Diagram of Markings, Ref. No. 23.

Customs personnel on duty only when notified at the customs subcollector's office. Directional wind indicator in northwest corner. Telephone connection, fuel, and water supply. Facilities only for minor repairs. No hangar accommodation. Road communication good. Rail communication, C. P. R.

Licensee.—Town of Virden.

Sault Ste. Marie, Ontario, *commercial seaplane station.*—Situated on St. Mary's River, near the Imperial Oil Co.'s dock. Latitude 46° 31′ N., longitude 84° 21′ W. Altitude, 583 feet above sea level. Local magnetic variation—3° W. Maximum dimensions for landing—over 800 yards. Licensed for use by day only and marked with an equilaterial triangle each side of which is 3 feet wide and 25 feet long. See Diagram of Markings, Ref. No. 28.

Telephone connection. Telegraph and telegraphic address—Spanish River Pulp & Paper Mills (Ltd.), Sault Ste. Marie, Ontario. Water and fuel supply. Mooring accommodation. Facilities for minor repairs. Available communication to city of Sault Ste. Marie, Ontario—Electric railway, 200 yards in a northerly direction, motor transport, good roads.

Licensee.—Spanish River Pulp & Paper Mills (Ltd.), Sault Ste. Marie, Ontario.

Brandon, Manitoba. *commercial air harbor.*—Situated ½ mile westward of city of Brandon, on Victoria Avenue. Latitude 49° 50′ N., longitude 99° 58′ W. Altitude 1,204 feet above sea level. Local magnetic variation, 15° 07′ E. Maximum dimensions for landing—400 by 600 yards. Licensed for use by day only and marked with a triangle divided by a vertical line. See Diagram of Markings, Ref. No. 26.

Directional wind indicator on hangar. Telephone number 2301. Telegraph and telegraphic address—Brandon Aerial Services, Prince Edward Hotel, Brandon, Manitoba. Facilities for top overhauls only. Water and fuel supply. Accommodation for one or two machines and a handling party stationed on the aerodrome. Available communication to the city of Brandon—electrict railway, motor transport, and good roads.

Licensee.—Brandon Aerial Services, Prince Edward Hotel, Brandon, Manitoba.

Chicoutimi, Province of Quebec, *commercial seaplane station.*—Situated on the Saguenay River, westward of the town of Chicoutimi, Province of Quebec. Latitude 48° 30′ N., longitude 71° 05′ W. Altitude—sea level. Local magnetic variation 21° 04′ W. Maximum dimensions for landing—over 800 yards. Licensed for use by day only and marked with an equilateral triangle, each side of which is 3 feet wide and 25 feet long. See Diagram of Markings, Ref. No. 28.

Directional wind indicator on hangar. Telephone number, 437 Chicoutimi. Fuel and water supply. Facilities for minor repairs. Hangar accommodation. Type of transport available locally—train, taxis, Saguenay River boats.

Licensee.—Price Bros. & Co. (Ltd.), Chicoutimi, Province of Quebec.

Rockliffe, Ottawa, Ontario, *aeroplane and seaplane station.*—Situated on the right bank of the Ottawa River, eastward of Rockliffe Rifle Range butts, opposite the center of Kettle Island. Latitude 45° 28′ N., longitude 75° 39′ W. Local magnetic variation 13° 07′ W. Altitude 200 feet above sea level. Maximum dimensions for landing 700 by 400 yards. Licensed for use by day only and marked with a triangle divided by two lines forming a cross into four approximately equal parts. See Diagram of Markings, Ref. No. 24.

Directional wind indicator on top of Rockliffe Rifle Range butts. Water and fuel supply (pipe line for seaplanes). Hangar and mooring accommodation. Handling party stationed on the aerodrome. Available communication to the city of Ottawa—electric railway, motor transport, good roads.

Licensee.—The Air Board, Ottawa, Ontario.

English Bay (Vancouver), British Columbia, *seaplane station.*—Situated at Jericho Beach near Vancouver. Latitude 49° 16′ N., longitude 123° 17′ W. Altitude—sea level. Local magnetic variation 25° 00′ E. Maximum dimensions for landing—over 4 miles square. Licensed for use by day only and marked with a triangle. See Diagram of Markings, Ref. No. 28.

Directional wind indicator on boathouse. Telephone, Bayview 4228. Telegraph and telegraphic address—Air Board Station, Jericho Beach, Vancouver, British Columbia. Water and fuel supply. Repair facilities. Hangar accommodation and a handling party at station. Available communication to the city of Vancouver—motor transport, motor boats, paved roads.

Licensee.—The Air Board, Ottawa, Ontario.

Deseronto, Ontario, *customs air harbor* (latitude 44° 10′ N., longitude 77° 08′ W.).—About 3½ miles westward of the town of Deseronto, Ontario. Altitude 260 feet above sea level. Local magnetic variation 10° 30′ W. Dimensions, 440 yards north and south by 800 yards east and west. Licensed for use by day only and marked with a double cross-barred square and enclosed circle. See Diagram of Markings, Ref. No. 20.

Customs personnel on duty only when notified at Deseronto custom-house. Directional wind indicator in southeastern corner. Telephone connection, fuel, and water supply. Road communication good; rail communication—C. N. R. 50 yards. Facilities for general repairs.

Licensee.—G. H. Harrold, Deseronto, Ontario.

Yorkton, Saskatchewan, *commercial air harbor.*—Situated on the northern half of section 18, township 26, range 3, westward of the 2d. Latitude 51° 16′ N., longitude 102° 33′ W. Altitude 1,655 feet above sea level. Local magnetic variation 19′ 02° E. Maximum dimensions for landing—under 300 yards. Licensed for use by day only and marked with a triangle divided by two straight lines forming a cross into four approximately equal parts. See Diagram of Markings, Ref. No. 24.

Telephone connection. Telegraph and telegraphic address—Yorkton Aerial Transport Co., Yorkton, Saskatchewan. Water and fuel supply. Facilities for minor repairs only. Available communication to the town of Yorkton—motor transport, dirt roads.

Licensee.—Donald Brown, Yorkton, Saskatchewan.

Lethbridge, Alberta, *commercial air harbor.*—Situated at Lethbridge Exhibition Grounds, 2 miles eastward of the city of Lethbridge. (Latitude 49° 40′ N., longitude 112° 50′ W.) Local magnetic variation 23° 15′ E. Maximum dimensions for landing—600 by 800 yards. Licensed for use by day only and marked with a triangle containing a circular dot in the center. See Diagram of Markings, Ref. No. 27.

Directional wind indicator on hangar. Telephone connection. Telegraph and telegraphic address—Lethbridge, Aircraft Co. (Ltd.), Lethbridge, Alberta. Water and fuel supply. Facilities for minor repairs only. Hangar accommodation. Available communication to the city of Lethbridge—motor transport, good roads, electric railway ½ mile west of aerodrome.

Licensee.—Lethbridge Aircraft Co. (Ltd.), Lethbridge, Alberta.

Fredericton, New Brunswick, *customs air harbor* (*seaplane*).—(Latitude 45° 30′ N., longitude 66° 39′ W.) Situated on the St. John River—on the western side of Fredericton Highway Bridge. Altitude 18 feet above sea level. Local magnetic variation 21° W. Dimensions—over 800 yards north and south and over 800 yards east and west. Licensed for use by day only and marked with a circle enclosed in a square. See Diagram of Markings, Ref. No. 23.

Customs personnel on duty when notified at the collector of customs' office, Fredericton. Telephone, gasoline, oil, and water supplies. Power launch and two mooring buoys available. A wind indicator is placed on the southern shore of the St. John River, approximately 600 yards westward of Fredericton Highway Bridge.

Communication.—Road and railway—C. N. R. and C. P. R. Station half a mile southward of the air harbor.

Licensee.—City of Fredericton.

Dartmouth, Nova Scotia, *seaplane station.*—Situated 4 miles southeastward of the city of Dartmouth, opposite northern end of McNab Island. Latitude 44° 38′ N., longitude 63° 31′ W. Local magnetic variation 22° 07′ W. Altitude—sea level. Maximum dimensions for landing—over 800 yards. Licensed for use by day only and marked with an equilateral triangle, each side of which is 3 feet wide and 25 feet long. See Diagram of Markings, Ref. No. 28.

Directional wind indicator on hangar. Telephone connection. Telegraph and telegraphic address—Air Board Station, Dartmouth, Nova Scotia. Water and fuel supply. Facilities for repairs. Hangar accommodation and a handling party stationed at the air harbor. Available communication to the city of Dartmouth—motor transport, good roads.

Licensee.—The Air Board, Ottawa, Ontario.

Hampstead, Province of Quebec, *commercial air harbor.*—Situated ½ mile northward of the town of Hampstead (near Montreal), Province of Quebec. Mount Royal 2 miles southeast. Blue Bonnet Race Track ½ mile north. Latitude 45° 33′ N., longitude 73° 42′ W. Altitude 125 feet above sea level. Local magnetic variation 15° 09′ W. Maximum dimensions for landing, under 300 yards. Licensed for use by day only and marked with a triangle divided by two lines forming a cross into four approximately equal parts. See Diagram of Markings, Ref. No. 24.

Water and fuel supply. Facilities for running repairs only. No machine accommodation. Available communication to the city of Montreal—¼ mile to electric railway; good roads.

Licensee.—Plante Aerial Service, 161 Craig Street West, Montreal, Province of Quebec.

High River, Alberta, *commercial harbor.*—Situated 2½ miles northeastward of the town of High River, Alberta. Latitude 50° 36′ N., longitude 113° 51′ W. Local magnetic variation 24° 02′ E. Altitude 3,394 feet above sea level. Maximum dimensions for landing—600 by 800 yards. Licensed for use by day only and marked with a triangle with a circular dot in the center. See Diagram of Markings, Ref. No. 27.

Directional wind indicator on pole near hangar. Telephone number, High River 187. Telegraph and telegraphic address—Air Board Station, High River, Alberta. Water and fuel supply. Repair facilities for D. H. 4's and Rolls-Royce engines. Machine accommodation and a handling party stationed on the aerodrome. Available communication to the town of High River—motor transport, graded dirt roads.

Licensee.—The Air Board, Ottawa, Ontario.

Moose Jaw, Saskatchewan, *customs air harbor.*—(Latitude 50° 24′ N., longitude 105° 34′ W.) Situated in Lynbrook Heights, addition to the city of Moose Jaw. Altitude 1,865 feet above sea level. Local magnetic variation, 20° 15′ E. Dimension—400 yards north and south and 700 yards east and west. Licensed for use by day only and marked with a square and circle inserted divided in equal parts by a vertical line. See Diagram of Markings, Ref. No. 21.

Customs personnel on duty when notified at the collector of customs' office, Moose Jaw. Directional wind indicator on western side of aerodrome. Telephone connection and water supply. There are facilities for repair, fuel supply, and machine accommodation, and a handling party is stationed on the aerodrome.

Available communication to city—Electric railway adjoining aerodrome. Good roads.

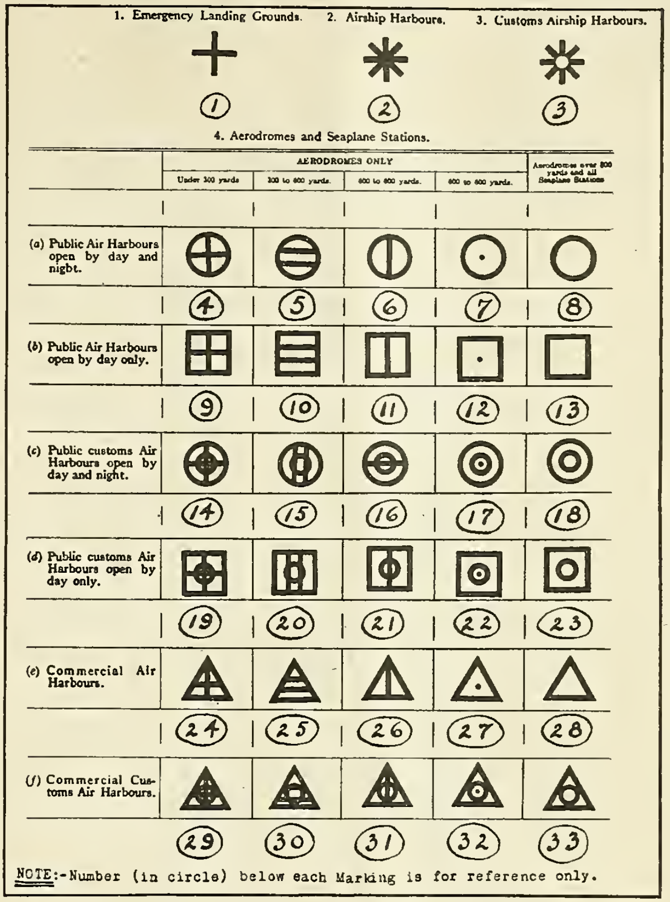
Licensee.—City of Moose Jaw, Saskatchewan.

Operated by the Western Aeroplane Co. (Ltd.), Moose Jaw, Saskatchewan.

Bowness Park, Alberta, *commercial air harbor.*—Situated 6 miles westward of Calgary, Alberta. Latitude 51° 06′ N., longitude 114° 13′ W. Altitude 3,765 feet above sea level. Local magnetic variation —25° E. Maximum dimensions for landing—300 yards square. Licensed for use by day only and marked with a triangle divided by a cross into four approximately equal parts. See Diagram of Markings, Ref. No. 24.

Directional wind indicator on hangar; telephone number, 3505. Water and fuel supply. Facilities for minor repairs only. Accommodation for two light machines. Available communication to the city of Calgary—electric railways adjoining aerodrome, dirt and asphalt road.

Licensee.—McCall-Hanrahan Aero Service, 515 Grain Exchange Building, Calgary, Alberta.


1. Emergency Landing Grounds.
2. Airship Harbours.
3. Customs Airship Harbours.
①
②
③
4. Aerodromes and Seaplane Stations.
AERODROMES ONLY
Under 300 yards
300 to 400 yards.
400 to 600 yards.
600 to 800 yards.
Aerodromes over 800 yards and all Seaplane Stations
(a) Public Air Harbours open by day and night.
④ ⑤ ⑥ ⑦ ⑧
(b) Public Air Harbours open by day only.
⑨ ⑩ ⑪ ⑫ ⑬
(c) Public customs Air Harbours open by day and night.
⑭ ⑮ ⑯ ⑰ ⑱
(d) Public customs Air Harbours open by day only.
⑲ ⑳ ㉑ ㉒ ㉓
(e) Commercial Air Harbours.
㉔ ㉕ ㉖ ㉗ ㉘
(f) Commercial Customs Air Harbours.
㉙ ㉚ ㉛ ㉜ ㉝
NOTE:-Number (in circle) below each Marking is for reference only.

Diagrams Showing the Markings of Canadian Air Harbors

Burrard Inlet, Vancouver, British Columbia, *commercial seaplane station.*—Situated at the foot of Burrard Street, on Burrard Inlet, Vancouver Harbor, Latitude 49° 16′ N., longitude 123° 06′ W. Altitude—sea level. Local magnetic variation 25° 00′ E. Maximum dimensions for landing—approximately two square miles. Licensed for use by day only and marked with an equilateral triangle, each side of which is 3 feet wide and 25 feet long (inside measurement). See Diagram of Markings, Ref. No. 28.

Directional wind indicator—conical streamer on hangar. Water supply; facilities for overhauling Curtis OX5 engines; fuel supply and accommodation for one machine.

Available communication to city of Vancouver—electric railway and paved roads.

Licensee.—The Aircraft Manufacturers (Ltd.), 1004 Standard Bank Building, Vancouver, British Columbia.

(*Concluded on page* 379)

AERONAUTIC ROADS—BLOCK SYSTEM

Addenda to Article of Aug. 22, 1921—Aerial Age Weekly

To avoid duplicate markers, the following method can be adopted. Referring to the map accompanying the article of Aug. 22, the southern transcontinental line traverses blocks 16, 8, 7, 17 and 25. If the posting is done on a single line of tower locations starting, for example, with towers 25, 24, 23, 22 and 21 of 100-mile blocks F, E, B and A of block 16, these same numbers will be repeated in blocks 8, 7, 17 and 25, but if an offset is made between the major blocks, we will strike different tower numbers; for example, at the junction of blocks 16 and 8 a side step can be taken to the next line of locations, which will be a 20-mile offset, say to the north, and we will then strike locations 20, 19, 18, 17 and 16 of the 100-mile blocks F, E, B and A in block 8. Then coming to block 7 let there be another 20-mile offset to the north and the tower location will be at points 15, 14, 13, 12 and 11 of F, E, B and A. Again at block 17 another 20-mile offset, bringing the line on to locations 10, 9, 8, 7 and 6; and another jump at block 25, shifting the line to locations 5, 4, 3, 2 and 1. Then finally at block 31 another offset to locations 25, 24, 23, 22 and 21 of blocks P and O.

There will then be no duplicate markers at any point on the line. The same method can be followed with respect to north and south lines.

If a lane is posted with alternate right and left location at 40-mile intervals on the side lines, then at the junction of two blocks the alternations can be reversed. This will avoid duplicate marking for a stretch of 800 miles, and the line can then be shifted to an entirely different set of locations.

Aeronautic Roads, A Continental System

The project for posting the country should be considered from a continental standpoint and the cooperation of Canada and Mexico invited, so that in its development it will become a homogenous system for the Continent and the Continental Islands, without breaks at the national borders.

All markers, whether in Newfoundland, British Columbia, Missouri, Tamaulipas or Sinaloa, should be alike in character and significance. This does not mean the marking of installations under a joint commission but simply an agreement as to the general plan and marker details.

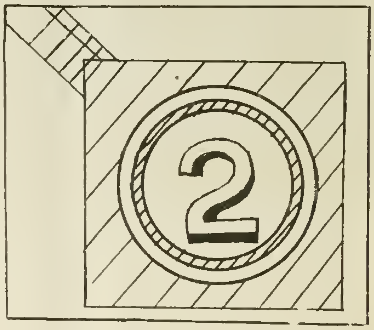
Each country will have its own series of major blocks with uniformity in block subdivisions and marker devices. A border block can carry, with respect to the respective countries, the number pertaining to that system. Thus block 1 of the U. S. system, as projected, covers in the United States, portions of North Dakota and Minnesota; and in Canada portions of Manitoba and Saskatchewan. If the number for this block, in the Canadian system is, for example, "16," "1 P 22" will identify a marker in Western Minnesota, and "16 A 10" (Canadian) a marker in the same block, near the Manitoba-Saskatchewan line.

In referring to a Mexican or Canadian location, from our standpoint, a prefix identifying the system can be used, for example, "Mex. 2 D 23" or "Can. 16 A 10."

Urban and Industrial Districts and Inside Markers

It is very possible that industrial districts may take up the posting of their territory, so that an aviator approaching the district can get his bearings. For example, take the Birmingham District, including Bessemer, Ensley, Pratt City, etc., Alabama. If this is surrounded by a cordon of markers, a flier, from whatever direction he approaches, can get his bearings and locate the landing field.

In some cases it may be desirable to provide markers within the confines of a 20-mile block; for example, in proximity to the landing field. Most of this Birmingham District lies in block "16 C 2," for which the platform contour is a square with an arm to the northwest. A marker within this block can show the same indications, a square platform with an arm to the northwest and the central number "2." To show that it is an auxiliary marker, the platform can be made with an inside ring around the number, and a narrow annual space between the ring and the platform proper. This device can be used for all inside markers, indicating that the marker is within the area of the block indicated, the position of same being shown on the map.



An "X" after a marker designation will indicate that it is an inside marker, generally in proximity to a landing field, within the 20-mile block. Thus, "16 C 2 X" refers to a marker for the landing field for the Birmingham District.

Maps

The keeping of aeronautic maps up to date will be a simple matter. As installations are made, the location designations will be published by the press as items of general interest and the airmen will mark the new installations on their maps.

Alaska

A project that should be given attention is the posting of Alaska. For example, the route from Seattle up the coast to Juneau, and from there to Seward, Fairbanks and Nome. The block system can be extended to cover this territory.

THE WORK OF THE FOREST PRODUCTS LABORATORY

FOR more than 10 years the Forest Products Laboratory at Madison, Wisc., has been studying wood, always with the object of developing its most efficient and economical use. During that period it has amassed a great deal of scientific information of the most practicable application. Great credit is conceded the Laboratory for its research accomplishments but in the final analysis the value of its work must be measured by the extent to which the results of its work are made known and effectively applied by the wood manufacturing industries. It is believed that this phase of the Laboratory's work is not being developed to an extent which its research results and industrial needs justify.

It is well recognized that those in charge of the work at the Laboratory have been endeavoring to remedy this situation as evidenced by the information disseminated currently through trade and technical publications, by direct distribution of technical notes, by instructional courses in box construction and kiln drying, and in the facilities offered for direct cooperation in applying its information to specific manufacturing problems. In order to develop its dissemination work even to this extent, it has been necessary for the Laboratory in certain cases to require cooperators to bear the cost of dissemination. This of necessity limits the broad usefulness of the Laboratory and tends to restrict its information and services to the relatively few individuals and companies which are conversant with its work and the value of its results.

This is a situation which ought not to exist. It is one easily remedied, and the remedy lies in a specific appropriation by Congress for the dissemination and application of the Laboratory's results commensurate with its research activities and accomplishments.

The application of research is largely a matter of education, and when research is conducted as a governmental activity, adequate facilities must be provided for carrying the results through to their commercial application. This seems so thoroughly established as to forego argument. In its agricultural research and development the Department of Agriculture has solved the problem in a highly satisfactory and profitable way by placing county agents in every state in the Union, whose duties are to advise and educate the farmers in better methods of farming.

There is at Madison, we understand, a great deal of information which it has never been possible to supply the industries, because the Laboratory has not had the money or men to put this information in usable shape for the business man. We believe that the Laboratory should have at Madison an adequate force to prepare all its data of practical application in a form which the business man can readily grasp and apply. We believe that in addition, the Laboratory should have a group of men whose whole time is devoted to field work. The duties of these men should be to carry the information, now available at the Laboratory and being made use of by the relatively few, to the men in the sawmill, or in the lumber yard, or in the wood using plant. Personal contact, after all, is the most effective means of disseminating practical, scientific information. Members of the Laboratory and of the industries who have come together personally are first to admit this. But relatively few of the industries have the means or inclination to go to Madison and there investigate for themselves the information which they may make use of.

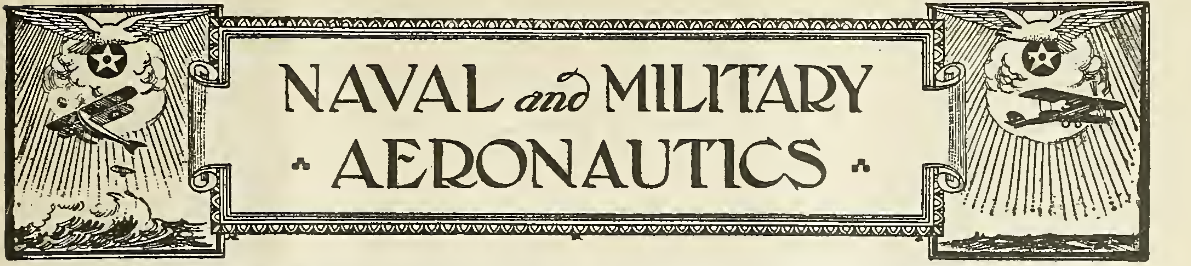
As concrete examples of some of the ways by which the dissemination of the Laboratory's work should be developed, the following are mentioned: expansion of its instructional work in kiln drying, box construction, and special co-operative tests under a plan by which the expense is at least shared equally by the Government and the co-operator; the assignment of Laboratory field representatives to disseminate its results by personal contact in such fields as the preservation of mine timbers, the kiln drying of lumber, the proper working values of wood in building codes, the protection of wood pulp and pulpwood from decay in storage; and the demonstration on a commercial scale of the Laboratory's work in developing improved processes, such as the cooking and bleaching of southern pine for magazine and book paper, increasing the yield of wood alcohol in destructive distillation, the utilization of sawdust and mill waste for cattle food, and the de-inking of old magazines and newspapers so that the stock may be reused.

The current annual appropriation for forest products research amounts to $325,000. This is equivalent to less than 25 cents for every $1000 of raw manufactured value for the total annual cut of wood. On the other hand, the Department of Agriculture is spending for agricultural research and development $1.50 for every $1000 of value of all agricultural and animal products.

We believe that for the reasons already stated the Laboratory's appropriation should be increased a minimum of $100,000. The Secretary of Agriculture and the Director of the Budget have approved $340,000 for the research work of the Laboratory for the fiscal year beginning July 1, 1922. These estimates will be presented to the new Congress early in December. They are contained in the estimates for the Forest Service, U. S. Department of Agriculture, and will be considered first by the Sub-committee on Agriculture of the House Committee on Appropriation and later by the Senate Committee on Agriculture. The Honorable Sidney Anderson of Minnesota is chairman of the House Sub-committee.

Those interested in the effective continuation and development of the Forest Products Laboratory should see that their local representatives in Congress are impressed with the importance not only of providing the normal appropriations for its work but in urging the moderate increase for the special purposes outlined.

NOTE—This statement prepared and distributed by the Association of Wood Using Industries.



NAVAL and MILITARY AERONAUTICS

Germans to Build Zeppelin for U. S.

Washington, Dec. 17.—Authorization by the Allied Council of Ambassadors for the construction by Germany of a Zeppelin of the L-70 type for the United States was regarded in official circles here as a distinct triumph for American diplomacy.

By virtue of that authorization Germany is permitted to go behind the terms of the protocol signed in Paris last June, which limited the size of airships she might built to 30,000 cubic meters capacity. The airship which Germany will build for the United States is to be of 70,000 cubic meters capacity.

The opposition of the European Governments was overcome by repeated representations by Ambassador Herrick that this country would not use the new airship for military purposes and that America was entitled to compensation in kind for the Zeppelin awarded this Government and later destroyed by Germany.

Under the decision of the Council of Ambassadors Germany will construct a Zeppelin of the L-70 type at the Friedrichshafen hangar, the only one in Germany large enough to permit the building of an airship of that size, and then will tear down the hangar and disperse the mechanics brought together to fabricate the air monster. The completed airship will be delivered to the United States in Germany without the expenditure of a single penny by this Government, it was stated, and then will be flown across the Atlantic by a crew of Navy Department aeronauts. Construction of the airship will be under the direction of a staff of American navy experts.

The German L-70 class of airship measured 743 feet in length, 48 feet longer than the British ZR-2, but having the standard German diameter of 78,4 feet. Their total useful load was more than 88,000 pounds, equivalent to 59 per cent of the total weight of these ships. The ships carried by a crew of thirty men each. They were driven by seven Mayback engines of 290 horse power each, arranged in six power cars suspended below the belly of the ship, two being placed in the after car, giving a total horse power of 2,030, and developing a speed of over 80 miles an hour.

Announcement that the Government had obtained permission to construct a rigid airship in Germany was followed by the disclosure that two German aircraft engineers visited this country several months ago to study possibilities of a fast Zeppelin service between Germany, New York and Chicago.

The engineers were said to represent the Zeppelin Airship Building Company of Friedrichshafen and gave their names as Harry Vissering and E. A. Lehman. They were in frequent conference with Weather Bureau officials. It is learned that they discussed plans for a passenger and mail carrying fleet of Zeppelins to ply between Germany and America.

Admiral Moffatt Endorses Aviation Bill

Washington. — Legislation now before Congress for the establishment of a Bureau of Civilian Aeronautics under the jurisdiction of the Department of Commerce received the endorsement of Rear Admiral William A. Moffatt, Chief of the Bureau of Aeronautics of the Navy Department, who had a conference with President Harding, Dec. 14.

Admiral Moffat's appointment with the President was the result of a conversation he had with Mr. Harding when the latter attended the manoeuvers of the Marine Corps over the Wilderness battleground in Virginia last Fall, when the President intimated that he would like to hear further the Admiral's views on aviation questions.

It is the apparent view of army and navy aviation experts that commercial aviation must be developed by government agencies outside the War and Navy Departments, and that civilian aviation should be encouraged as an potential auxiliary to the naval and military flying forces in time of war. At present the only Federal encouragement to aircraft manufacture has come from the army and navy experimentors and obviously this does not furnish sufficient business to warrant serious investment in aeroplane factories.

Urges Roma Be Sent to Mitchel Field

Major W. R. Weaver, commandant at the Mitchel Aviation Field, near Mineola, is trying to induce the War Department to send the dirigible Roma, recently purchased from the Italian Government, on a flight from Washington to and over New York city. He has written to the department asking for an appropriation to construct an airship mooring at Mitchel Field.

Major Weaver said that he has asked for $1,000, and that if he succeeds in getting the money he will then urge the War Department to send the Roma here. The concrete work of the mooring alone, he said, would be about $650.

Mitchel Field is soon to become the center of air service activities in the East. The personnel of the field is to be increased and soon eight air units will be established there.

Deliver Seaplane Carrier.

The Todd Shipyards Corporation has turned over to the United States Navy the U. S. S. Wright which has been converted into a balloon and seaplane mother ship in the Tietjen and Lang Shipyard, Hoboken. The vessel is named in memory of Wilbur Wright.

The Wright was originally built for the transport service and the alterations include space for the stowage of six kite balloons, a plant for generating hydrogen and repair plants for balloons and seaplanes. The vessel will carry spare wings and other parts and will also be equipped with a pigeon coop, aerological laboratory and a complete photographic laboratory. She will be armed with four five-inch guns and two machine guns.

The Wright is 448 feet long, 58 feet beam and 31 feet depth and of 14,240 tons displacement. She will have a cruising speed of 15 knots.

Eighteen Years of Flight

Eighteen years ago, December 17, the world's first aeroplane flight was made by Orville Wright at Kitty Hawk, N. C. In a crude, insecure biplane, Wright attained a speed of thirty miles an hour, the duration of his flight being fifty-nine seconds. Since then the progress of aviation, aided by the war impetus, has been so rapid that now continuous flights of more than twenty-four hours and speed of more than 175 miles an hour are common.

In his first statement since the war, issued from the office of the Aeronautical Chamber of Commerce, 501 Fifth Avenue, Mr. Wright recalls his first effort at flying.

"Just eighteen years ago, on December 17, 1903, after centuries of endeavor, man for the first time was lifted into the air by a power propelled aeroplane," Mr. Wright says. "Flight seems so easy today that one naturally wonders at the long delay in its accomplishment. Yet eighteen years ago, on account of the thousands of failures, flying was classed with perpetual motion and the few who expressed belief in its possibilities were looked upon as mentally unbalanced. Up to 1900, only a few measurements of aeroplane wings had been made along successful lines. Most flying experiments up to that time had been made on the 'cut and try' plan; and by that plan flight probably would not have been accomplished for centuries yet to come.

"The problem was not one to be solved by guesswork. Duechemin, about the middle of the last century, had published a formula for calculating the pressure on planes at different angles. Lillienthal, in the eighties, had published his measurements on several curved surfaces, with other valuable scientific work. Langley, in the nineties, published his measurements of plane surfaces, corroborating the earlier work of Duechemin. It was to the work of Lillienthal that my brother and I were by far most deeply indebted. But owing to various defects in the systems of measuring all of this work, we found it too inaccurate and too meagre for purposes of design.

"In 1901, my brother Wilbur and I having proved by actual gliding tests the inaccuracy of these tables, began a scientific study of the subject. We designed new types of measuring instruments and made measurements of hundreds of differing wing surfaces in a wind tunnel. It was due to the accuracy of these measurements that we were able, in 1903, to design a new type of biplane, almost entirely from calculation, which was able to lift itself and operate into the air with a crude motor weighing more than twelve pounds per horsepower. We had already developed a new system of control, the system with which our name has been so largely connected, but this system of control would have been of little use without our wind tunnel work, which enabled us to design a machine which would lift itself."

Mr. Wright, in a prophetic vein, wonders what another eighteen years of progress will develop in aeronautics. He believes that aeroplane is still in its infancy and that the use of the aeroplane as a carrier will be universal.

Personal Pars

Major W. R. Weaver has been ordered to assume command at Mitchel Field.

Lieut. T. J. Koenig has been ordered to duty in the office of the Chief of the Air Service.

FOREIGN NEWS

French Aerial Lighthouse

From France it is reported that the French Air Ministry has recently acquired a new aerial lighthouse which is said to eclipse entirely anything that has hitherto been attempted in the way of lighting up the air routes. The new lighthouse, which, it is stated, is to be erected on Mt. Africa, near Dijon, at an altitude of 1500 feet above sea level, will throw a light which, in clear weather, it is expected will be visible for a distance of 200 miles.

Activity in Mexico

According to the November 28th issue of Commerce Reports, issued by the United States Department of Commerce, commercial aviation in Mexico is rapidly expanding, and thus giving proof of the increasing importance of this branch of the automotive industries. The Secretary of Communications of Mexico, according to El Campo of September, 1921, has made arrangements with a foreign company with a view to establishing an aerial transportation service for passengers and cargo between Mexico City and Tampico. The operating company made the first trip with passengers, mail, and cargo on September 1, taking two-and-a-half hours from Mexico City to Vera Cruz and one hour from Vera Cruz to Tampico. When the shipment of the fifteen machines arrives, the services will be extended to include San Luis Potosi, Monterey, Laredo, and Matamoros. A special service will be established between Tampico and Laredo.

A commercial aerial service between Juarez City and the City of Chihuahua is definitely planned. The distance between the two points is approximately 360 kilometres, and the journey takes 10 hours by rail and 12 hours by automobile. The aeroplanes, which will be piloted by American aviators, are expected to make the journey in less than two hours. Special flights are planned to mining camps and other nearby places, with the consent of the mine owners. The landing fields in Juarez City have been chosen, and permission has been obtained from the authorities of El Paso to use the field of Fort Bliss, near the frontier, for landing purposes.

The Pescara Helicopter

In the course of trials carried out at Barcelona, the helicopter invented by the Spanish engineer, Senor Pescara, rose one meter from the ground; the inventor then demonstrated that the machine could tilt either backwards or forwards, and turn in a circle. These trials were carried out in a garden sixteen metres long and ten metres wide, while a wind of thirty kilometres an hour was blowing. No cables or gas balloons were used as supports. Senor Pescara will continue his experiments in France. He intends shortly to bring his machine to the Villacoublay Aerodrome.

Ocean Airships

The following interesting article by Major C. C. Turner was published by the London Observer:

Before the end of 1923 at least one regular airship line between South America and the Old World will be in operation, and the east coast of Latin-America, with its great cities of Buenos Aires, Rio Janeiro, and Pernambuco, will be separated from London by no more than five days. All parts of South America—even those not directly on the air routes—will be brought nearer; and the West Indies will certainly by that time have flying-boat services with connections to the airship lines. It is highly probable, too, that by the end of 1923 New York and London will be served by a line of airships. The first great step in the establishment of trans-ocean air services is, however, due to Spanish-German enterprise, to the co-operation of German airship experts with the Spanish shipping company, the Compañia Transatlantica, with a view to services between Cadiz and Buenos Aires.

German airship engineers have for some time been in Spain, and the Spanish Government deputed Major Herrera to confer with them. The head of the German party is Herr Hugo Eckener, formerly associated with Count Zeppelin. The Commission has chosen an airship site between Seville and Cadiz; and Major Herrera and two other Spanish experts, with two Germans, paid a visit to Argentina with the object of choosing sites, studying the conditions, and obtaining financial support from the Argentine Government. They have reported to the effect that it will be necessary to use larger airships than any yet constructed (with the exception of R38), and that the weather on the European side is favorable, but that on the American side it would be necessary to have a revolving shed. Seven German airship sheds were allocated to France, and if the French Council of National Defence is able to persuade the Government to agree to the Air Department's airship program these sheds will be re-erected at Marseilles, Paris, Tunis, Casablanca, Algiers, and Dakar (Senegal).

Paris (Orly) will be the principal French airship base; and, indeed, the installations necessary for carrying on construction are already in an advanced stage. They include big gas-holders, airship sheds and workshops, and a Customs house. Mooring masts definitely appear in the French programme.

The French Government cut down the airship program in this year's Budget Bill, and it is quite on the cards it may do so again. But the circumstances have changed materially; France cannot ignore the prospect of German airship construction and operation being maintained.

In examining the map of the Atlantic the climatic conditions should be considered. The route from Bathurst or Dakar to Pernambuco takes in the region of the South-East trades, and traveling either way airships would have these winds more or less abeam, this reducing their net speed. North of that region there is a large area of calm or variable wind; and north of this, again, the westerly winds of the North Atlantic prevail, a factor seriously to be reckoned with in any project for an air service between New York and Great Britain. This region begins about the parallel on which New York and Gibraltar are situated. Airships from Spain to Pernambuco would have a helping wind usually as far as the Cape Verde Islands, but would on the return journey over this section have to make headway against the wind. The coasts of Africa and South America are subject to monsoon seasons.

So far as Great Britain is concerned, airship affairs are at a standstill, and unless the Imperial air routes scheme is adopted, a complete abandonment of commercial airship development can only be averted by some private concern stepping into the breach. Nevertheless, in view of German and French activities, it is quite obvious that British neglect can only be of a temporary character. Sooner or later we must resume operations; although, by allowing things to drift, by abandoning construction, and permitting the dispersal of the technical, constructional, and operational staffs, we must eventually incur the utmost possible expense.

The British New Subsidy

It is rumored that a new sum has been allocated for next year's subsidy, and this will be allotted as follows:

To the gross takings, a sum equal to 25 per cent. of these will be added.

To each passenger's fare £3 will be added from the subsidy, and 3d. to each pound of goods.

That is to say, for each £6 passenger the air lines will get £3 net added, and a further £1 10s. as 25 per cent. of the gross takings, which means £10 10s. per passenger.

If the air lines cannot make themselves pay at that rate, then obviously civil aviation is a failure or else it is time that somebody with great business acumen took the business in hand.

The Fokker Incident

The matter of the Fokker exhibit at the Paris Aero Show has now become the subject of diplomatic representations.

It appears that the Fokker monoplane at the Grand Palais has been seized by the French Legal Authorities upon the representation of M. Robert Esnault Pelterie, who alleges it to embody an infringement of his control-lever patents. In consequence the Dutch Government, at the request of Mynheer Fokker, is reported to have made representations to the French Legation in Holland.

It is very difficult to believe that such an action as this could have occurred in any civilized country as the result of foreign participation in an exhibition alleged to be "International." But success in war has always produced among the Latin races a complete breakdown of that courtesy for which they are distinguished in their periods of humility.

Suspension of London-Amsterdam Air Service

The Postmaster-General announced that on and from November 19 the air mail service between London and Amsterdam has been suspended.

Death of Alfred Leblanc

It is with the greatest regret that we have to record the death, at the age of 51, in Paris, after a long illness, of the famous French pilot Alfred Leblanc. One of the very first French pilots, Leblanc was taught to fly by Louis Blériot, with whom he worked for a number of years. He was the winner of the famous Circuit de l'Est, and represented France in the earlier Gordon Bennett Races. For his distinguished services he was awarded the Cross of the Legion of Honour.

(Concluded from page 370)

Flat plate method. This method only differs in its results from the reflection method at angles approaching maximum lift for the Martin and the U. S. A. 27 and somewhat higher angles for the R. A. F. 15 Special. Above these angles the lift drops off abruptly and it is evident that the trailing edge has entered the region of slower moving air surrounding the flat plate. It will be noted that the redundant type of air flow found in the reflection method at high angles introduces less inaccuracy than is found here.

In *The Ace*, for December, 1920, an account is given of a test by Mr. A. A. Merrill, of the California Institute of Technology, of ground influence on a biplane model at the single angle of incidence of 13°. In an aeronautical report, No. 173, of the Construction Department, Navy Yard, Washington, D. C., dated February, 1921, are charts of a test made on an R. A. F. 6 aerofoil with the ground at various distances. In both of these tests, the flat plate method was employed. The results are in consonance with the work done with a flat plate in the present tests. In the tests on the R. A. F. 6 a decrease in lift at high angles was found. This report did not come to hand until the present tests were completed.*

Ground effect is not entirely beneficial. It decreases the landing speed and cushions the landing shock somewhat, but does so at the expense of an increased length of preliminary skimming over the ground. By decreasing the drag and increasing the lift it lengthens the distance necessary for the aeroplane to travel before losing enough speed to land.

On the other hand, its influence is helpful in taking off, especially in the case of flying boats with their low-lying wings. It points to the fact that the closer the wings are to the ground the easier it is to pick up speed. It promises economy for low-skimming flight over smooth water, provided such flight be practicable.

In the conventional tractor aeroplane, the height of the wings above the ground is determined largely by propeller clearance, but a small low-speed aeroplane like the Pischoff and large low-speed commercial aeroplanes with engines between wings can utilize ground influence to good advantage.

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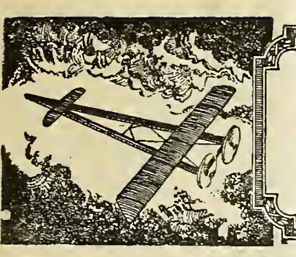
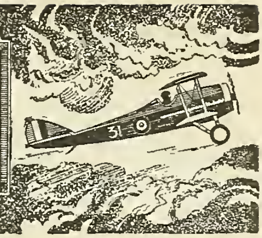
* In Fig. 5 three curves from the W. N. Y. tests are reproduced for comparison.



ELEMENTARY AERONAUTICS *and* MODEL NOTES



The Requirements of Aeroplane Engine Design

(*Concluded from page* 329—*Dec.* 12)

PERHAPS the most common cause of engine failure is faulty lubrication. Any failing in this direction is felt immediately by an engine working under the severe conditions of loading which obtain in aero practice.

Failures are commonly caused by dirty oil, which causes choking of the smaller oilways and thus cuts off the parts fed by them from any oil supply. Oil should always be filtered and the oiling system should always be flushed periodically. Indirectly the oiling system is affected by excessive wear, inasmuch as the oil escapes so readily from the worn bearings that others, less worn, do not get an adequate supply.

Ignition systems cause a certain amount of trouble. On most larger engines, however, the ignition is usually duplicated and complete failure therefore seldom occurs. Dirt, moisture and oil are the most frequent causes of trouble. Ignition troubles due to oiling are the most prevalent in the case of rotary engines because of the large amount of oil consumed. If the plugs are cleaned often and tested, and the distributors and contact breakers are kept clean, little trouble is experienced. The effects of moisture are usually only met with after an engine has been laid up for some time.

A third common form of trouble is carburetion, which, again, is nearly always caused by dirt or water. This, however, should seldom be met with if all the gasoline is passed through chamois leather before being put into the tanks.

Mechanical breakages, unless they be the result of oiling troubles, usually occur amongst the smaller parts of the engine, such as valves and their details. They may be the result of faulty material or design, and can be guarded against only by constant inspection.

Reliability and simplicity are very nearly related. Every additional part of an engine provides another possible source of breakdown. Furthermore, the more complicated an engine is, the more difficult it is to examine and clean. It is during the routine cleaning and examination that the distortion of parts, the wear, the loose nuts, and other common causes of failure are discovered. Some engines are so complicated that the exposure of parts which should be the subject of frequent examination is a matter of quite some difficulty. Consequently they rarely receive the attention they should. The moving parts, such as valve operating gear, etc., should, where possible, be enclosed in oil-tight casings, allowing for their adequate lubrication and at the same time giving the engine a clean external appearance. They should, however, be readily accessible.

Accessibility is always a difficult problem to the designer, as he has so many things to fit into the space available. The following parts, in the order named, should always be easy to get at: spark plugs, carburetor jets and filters, magneto contact breakers and distributors, oil filters, valve tappet adjustment, switch wiring, and control levers.

In the foregoing discussion the question of cleanliness has, perhaps, been somewhat elaborated, but it is of extreme importance. There is, however, another matter which exerts almost as great an influence on reliability, and that is the pilot's attitude toward his engine. The pilot who feels for his engine, runs it up carefully, never overloads it unnecessarily, and, when it is not working its best, nurses it, is very seldom faced with serious engine trouble.

Smooth running is essential. All vibration and roughness mean excessive wear somewhere and consequently affect the reliability adversely.

Compactness of design is essential. The space available for the engine is very limited. Low cross-sectional area in the direction of flight is important, especially in the case of machines where the engine is not built into the fuselage.

Many of the early types of engines were prone to catch fire. The chief cause of fire in engines is back-firing in the carburetor. A broken valve, or too weak a mixture (which commonly results from dirt or water in the jets), may cause a backfire. This may ignite the gasoline in the mixture chamber. For this reason the carburetor intakes should be carried clear of anything inflammable. Gasoline pipes liable to breakage should also be kept as clear of the carburetor intakes or exhaust outlets as is possible. Carburetor fires are usually quickly extinguished by being sucked through the engine. In the event of an engine fire, the last thing the pilot should do is turn the ignition switch off. The correct procedure is to turn off the gasoline and open the throttle, thus sucking the carburetors dry and also preventing the fire from being supplied with gasoline if one of the pipes has cracked or burned.

Oil and gasoline economy, apart from weight considerations, are of considerable importance in the commercial aeroplane. These items will constitute a large proportion of the running expenses. The vertical engine with large cylinders is at present the most economical. Fuel economy depends on the compression ratio, a high compression being most economical. With the present system of induction, the power of the engine falls off very greatly when the machine is flying at high altitude. Systems of forced induction promise considerable improvement, both in power and economy at varying heights.

The cost of aeroplane engines is a matter of quantity production. It need not be high. The war has provided sufficient data for standardization. The aeroplane designer need have little difficulty in selecting a suitable engine. Whatever machine it is for, proved reliability is the first essential. This taken for granted, a commercial balance, taking into consideration weight per horsepower, economy of running, and overhaul, and prime cost will have to be established.

Conservatism will always have to be reckoned with. Before any new engine is readily accepted by pilots, very complete proof of its reliability will have to be forthcoming. The comfort of having an engine with a reputation for never failing is inestimable.

Capitol Model Aero Club Activities

The Capitol Model Aero Club of Washington, D. C., is holding its meetings bi-weekly throughout the early winter months, and a keen interest in junior aviation is being manifested throughout that city. The members are decorating their new club room with photographs of aeroplanes and trophies of flying which the Air Service flying field has kindly loaned to them and a remarkable aerial atmosphere is apparent from the surroundings.

The Club is developing a supply base of its own, which caters to the needs of the members. The officers are designing a standardized racer which is expected to be the last word in efficiency as well as ease of production. New members are constantly coming in. The Club would be glad to communicate with all enthusiasts, and requests that mail be addressed in care of the President, Paul Edward Garber, at 1210 18th Street, N. W.

Junior Club of Aeronautics Organized

A group of young men of Kansas City, Missouri, have organized the "Junior Club of Aeronautics," of which the officers are Fred Hattoom, President, and C. H. Smitherman, Secretary and Treasurer.

Mr. Hattoom has recently completed a scale model of the Curtiss JN-4 with a span of 36 inches. All the measurements are as close to scale as possible in a model of this kind, some of the dimensions being scaled down from the real plane. The wings are covered and doped in the approved manner, giving a realistic effect to the model.

A-E-D-O-N-I-T-I-S

How It Feels

By L. L. De Jean

A friend of mine asked me one day:
"How does it feel to fly up high?"
I puzzled as to what I'd say,
And finally made this reply:
(P'r'aps it reveals.)

Have you e'er sailed upon the sea,
When it was rough, in a canoe?
Have you ne'er watched the bumblebee
From flow'r to flow'r his course pursue,
While sweets he steals?

Have you, in childhood days gone by,
Climbed up on top the barn to rob
A birdnest of its eggs, and spy
To see the pigeon feed the squab
Its wormy meals?

Have you gone coasting down a hill?
At sixty miles an hour or more?
Do you recall that breathless thrill,
As past all other sleds you tore,
'Mid joyous squeals?

Have you, sometimes, when fast asleep,
Gone floating thro' the atmosphere,
And dreamt you climbed in circles steep
Up to the stars, and felt no fear?
That's how it feels!

'Twas a cold November morning, and all the K-Dets were there,
And the crowd in front of the hangars looked on with many a stare;
The mechanics all were busy, like a flock of bees in a hive,
While Cowdrick was preparing for his famous hop in the S. E.-5.

"Will he get by with it?" someone asked. "Will he come safely down?"
"He may be able to do it," another said, "if he don't go 'round and 'round";
"All right, DeFord, pull the chocks, we'll take a chance with this bird."
So he giv'er the gun and left the ground and many groans were heard.

For most an hour he sailed the skies, each minute his confidence grew,
He figured he'd get by with it, it was wonderful the way he flew;
His time was up, so he headed in with a feeling glorious and grand,
And he was feeling rather cocky when he came in to land.

The ground was there to meet him as he approached with a lovely glide,
And he made a three-point landing, but the three was on one side;
When he scrambled out of the wreckage, he said he was glad to be alive,
And that he needed more D. H. time before tackling an S. E.-5.

Langley Field Times.

Unhappy Medium

Housekeeper: You've a big healthy man, why don't you work?

Tramp: Lady, I'll tell yer me trouble. I'm an unhappy medium.

Housekeeper: What do you mean?

Tramp: Well, I'm too light for heavy work and too heavy for light work.

Ad Valorem

She (pouting): You don't value my kisses as you used to.

He: Value them? Why, before we were married I used to expect a dozen in payment for a box of candy, and now I consider only one of them sufficient payment for a new dress.—*Boston Transcript.*

Chug-Hic-Chug

Smith: What makes Bill's Ford run so crookedly?

Jones: He put some alcohol in the radiator, and now it's a case of auto-intoxication.—*Gargoyle.*

"Why the bump on your head?"

"Oh, just a clubby party with the boys."

Irishman: That's a foine lookin' gown ye have.

Hostess (yawning): Decolleté.

Irishman: Sure, an' they call it naikid where oi come from.

Bloke: Who was that fellow you talked to so long on the corner?

Soak: He was my old barkeeper.

Bloke: What did he say?

Soak: He said, "No."—*Puppet.*

He: I suppose you dance.

She: Oh, yes. I love to (o).

He: Well, then, we'll love.—*Scalper.*

Jupiter and Near Beer

By Hugh Thomason

"Take away this watery near-beer!"
Said the king of gods and men;
"Never at Olympus' table
Let that truck be served again.

Ho, Lyacus, thou, the beery!
Quick invent some other drink;
Or, in a brace of shakes, thou standest
On Cocytus' sulphury brink!"

Terror shook the limbs of Bacchus,
Paly grew his pimpled nose,
And already in his rearward
Felt he Jove's tremendous toes;
When a bright idea struck him—
"Dash my thyrsus! I'm a stew
For you never were in Pedro—
That you know not old Home-Brew!"

"Bring it!" said the Cloud compeller;
And the wine-god brought the beer—
"Port and claret are like water
To the noble stuff that's here!"
And Saturnius drank and nodded,
Winking with his lighting eyes;
And amidst the constellations
Did the star of HOME BREW rise!"

"What's your idea of clean sport?"

"Swimming."—*Syracuse Oronge Peel.*

Great Developer

"Have you had much experience in a jazz orchestra?"

"Five years ago I was a physical weakling."

"Well?"

"Feel my muscles now!"—*Birmingham Age-Herald.*

Alimony

"I have just heard some good news."

"Is that so? What was it?"

"My wife got a divorce!"

"Did the judge give her any alimony?"

"I hope he did, I won't."—*Judge.*

Abie Ast—"You're ten minutes late."

She—"What of it?"

Abie—"What do you mean by keeping me standing here like a fool?"

She—"I can't help the way you stand."—*Far Seas.*

Feeling Foine

Flaherty: "Mr. Chairman, Oi move thot—"

Chairman: "The gentleman is out of order."

Flaherty: "Ye're a liar! Oi niver felt bether in me loife."
—*Boston Transcript.*

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(*Concluded from page* 373)

LAKE MINNEWANKA, ALBERTA, *commercial seaplane station.*—Situated 7 miles north-northwestward of Banff, Alberta, and 3 miles westward of Bankhead, Alberta. Latitude 51° 15′ N., longitude 115° 25′ W. Altitude 4,800 feet above sea level. Local magnetic variation 26° 00′ E. Maximum dimensions for landing—1,000 yards by 5 miles. Licensed for use by day only and marked with an equilateral triangle, each side of which is 3 feet wide and 25 feet long (inside measurement). See Diagram of Markings, Ref. No. 28.

Telephone—Bankhead line, ring one long and two short. Water and fuel supply. Facilities for repairs—poor. No machine accommodation. Available communication to city of Banff—taxis and motor buses. God gravel road.

Licensee.—A. W. Faulkner, Box 84, Banff, Alberta.

LEASIDE, ONTARIO, *customs air harbor.*—(Latitude 43° 42′ N., longitude 79° 21′ W.) Situated on the northeastern edge of the city of Toronto, 6 miles northward of Lake Ontario. Altitude—426 feet above sea level. Local magnetic variation, 6° 40′ W. Dimensions—400 by 600 yards. Licensed for use by day only and marked with a square and circle inserted, divided in equal parts by a vertical line. See Diagram of Markings, Ref. No. 21.

Customs personnel on duty when notified at the collector of customs' office, Toronto, Ontario. Directional wind indicator on hangar. Telephone connection and water supply. There are facilities for repairs, fuel supply, machine accommodation and a handling party is stationed on the aerodrome.

Available communication to the city of Toronto—Motor bus and trolley at Yonge Street, 3½ miles westward of the aerodrome, one mile by road to Leaside Station. Good roads.

Licensee.—The Ericson Aircraft (Ltd.) 120 King Street East, Toronto, Ontario.

VICTORIA BEACH, MANITOBA, *commercial seaplane station.*—Situated at Victoria Harbor, Manitoba. Latitude 50° 42′ N., longitude 96° 33′ W. Altitude 715 feet above sea level. Local magnetic variation 11° 05′ E. Maximum dimensions for landing—over 800 yards. Licensed for use by day only and marked with an equilateral triangle, each side of which is 3 feet wide and 25 feet long. See Diagram of Markings, Ref. No. 28.

Telegraph and telegraphic address—Air Board Station, Victoria Beach, Manitoba. Water and fuel supply. Facilities for repair to F.3 and H.S.2.L. flying boats. Slipway for beaching flying boats. Available communication to town of Victoria Beach—Motor boat and good roads.

Licensee.—The Air Board, Ottawa, Ontario.

NIAGARA FALLS, ONTARIO, *commercial air harbor.*—Situated on the Niagara to Chippewa Boulevard, 2 miles southward of Niagara Falls, Ontario. Latitude 43° 04′ N., longitude 79° 05′ W. Altitude 550 feet above sea level. Local magnetic variation 6° 05′ W. Maximum dimensions for landing—400 yards east and west; 300 yards north and south. Licensed for use by day only and marked with a triangle divided by two lines forming a cross into four approximately equal parts. See Diagram of Markings, Ref. No. 24.

Water and fuel suply. Facilities for running repairs only. No hangar accommodations. Available communication to Niagara Falls—motor transport, good roads.

Licensee.—Niagara Air Service, 618 Dominion Bank Building, Toronto, Ontario.

SASKATOON, SASKATCHEWAN, *commercial air harbor.*—Situated 3 miles northwest of City Hall, Saskatoon. Latitude 52° 10′ N., longitude 106° 43′ W. Altitude 1,650 feet above sea level. Local magnetic variation 23° 05′ E. Maximum dimensions for landing—300 by 400 yards. Licensed for use by day only and marked with a triangle equally divided by a vertical line. See Diagram of Markings, Ref. No. 26.

Water and fuel suply. Facilities for running repairs only. Accommodation for two machines. Available communication to city of Saskatoon—motor transport, good roads.

Licensee.—R. J. Groome, Box 285, Regina, Saskatchewan (Y.M.C.A., Saskatoon, Saskatchewan).

Dinner for Aviator Cooper

Merian C. Cooper, newspaper man, formerly a Captain in the American Air Service in France and later a Lieutenant Colonel of the Kosciusko Squadron of the Polish Army, was the guest of honor at the fourth annual dinner in the Hotel Gonfarone, New York City, of the Beaumont Club, composed of former members of the 200-201 Aero Squadrons, A. E. F.

Mr. Cooper is one of the two pilots in the service of the Polish Army who survived the experience of being brought down behind the Bolshevist lines, and it was with an account of his ten months' imprisonment in Russia and his escape last April to Riga that he entertained the guests.

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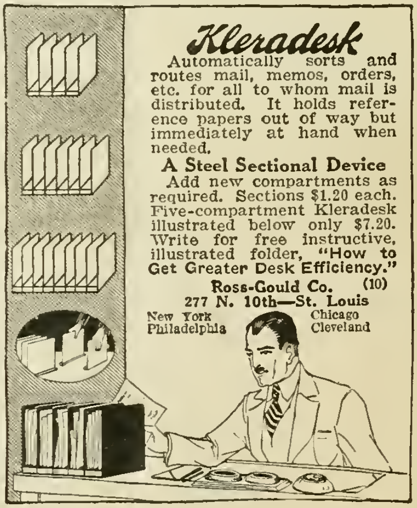

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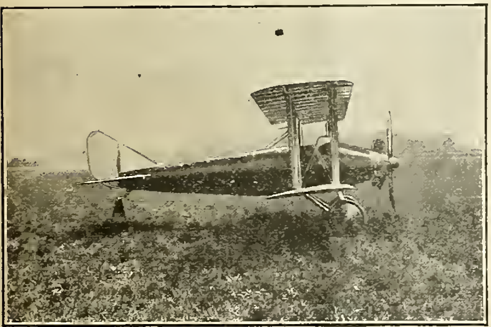

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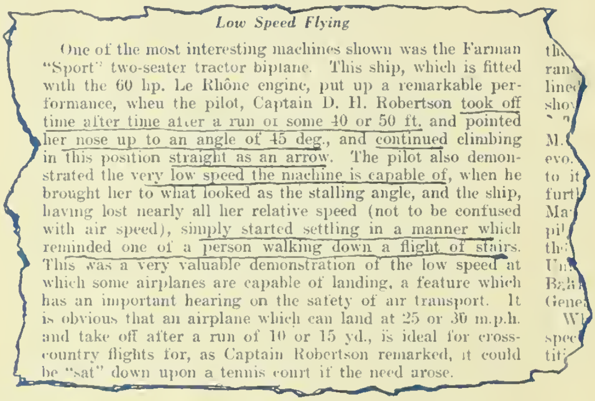


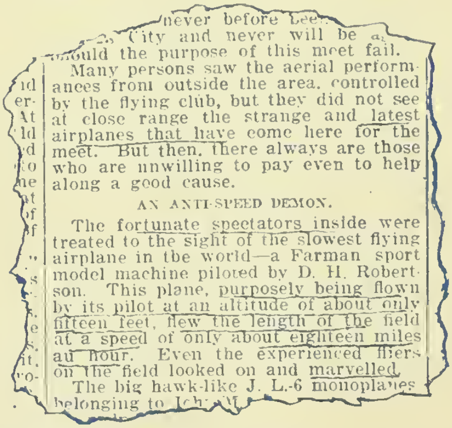
Low Speed Flying

One of the most interesting machines shown was the Farman "Sport" two-seater tractor biplane. This ship, which is fitted with the 60 hp. Le Rhône engine, put up a remarkable performance, when the pilot, Captain D. H. Robertson took off time after time after a run of some 40 or 50 ft. and pointed her nose up to an angle of 45 deg., and continued climbing in this position straight as an arrow. The pilot also demonstrated the very low speed the machine is capable of, when he brought her to what looked as the stalling angle, and the ship, having lost nearly all her relative speed (not to be confused with air speed), simply started settling in a manner which reminded one of a person walking down a flight of stairs. This was a very valuable demonstration of the low speed at which some airplanes are capable of landing, a feature which has an important hearing on the safety of air transport. It is obvious that an airplane which can land at 25 or 30 m.p.h. and take off after a run of 10 or 15 yd., is ideal for cross-country flights for, as Captain Robertson remarked, it could be "sat" down upon a tennis court if the need arose.

AT ETAMPES, FRANCE. June 19th. Established World's Record for Range in Speed, flying a closed course at the low speed of **15 5/8** miles per hour and immediately afterward at the high speed of **90** miles per hour.

AT KANSAS CITY, MO. American Legion Flying Meet—Oct. 31st-Nov. 3d.

(Kansas City "Times"—Nov. 1st.)



never before bee
City and never will be a
ould the purpose of this meet fail.

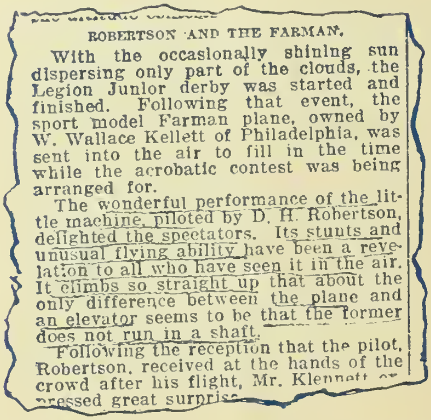
Many persons saw the aerial performances from outside the area, controlled by the flying club, but they did not see at close range the strange and latest airplanes that have come here for the meet. But then, there always are those who are unwilling to pay even to help along a good cause.

AN ANTI-SPEED DEMON.

The fortunate spectators inside were treated to the sight of the slowest flying airplane in the world—a Farman sport model machine piloted by D. H. Robertson. This plane, purposely being flown by its pilot at an altitude of about only fifteen feet, flew the length of the field at a speed of only about eighteen miles an hour. Even the experienced fliers on the field looked on and marvelled.

The big hawk-like J. L.-6 monoplanes belonging to Ich

(Kansas City Star—Nov. 2d.)



ROBERTSON AND THE FARMAN.

With the occasionally shining sun dispersing only part of the clouds, the Legion Junior derby was started and finished. Following that event, the sport model Farman plane, owned by W. Wallace Kellett of Philadelphia, was sent into the air to fill in the time while the acrobatic contest was being arranged for.

The wonderful performance of the little machine, piloted by D. H. Robertson, delighted the spectators. Its stunts and unusual flying ability have been a revelation to all who have seen it in the air. It climbs so straight up that about the only difference between the plane and an elevator seems to be that the former does not run in a shaft.

Following the reception that the pilot, Robertson, received at the hands of the crowd after his flight, Mr. Klennett ex-
pressed great surpris

Space limitations permit the printing of only a very few extracts from the many news accounts describing the wonderful performances of the Farman witnessed by Government Officials, Aeronautical Men and Press Representatives. Brief accounts of its flights at Omaha, Nebr., Baltimore, Md., Washington, D. C., Brussels, Belgium, will appear in following numbers of "Aerial Age."

TYPES: Two-seater Touring—Motor. New Anzani—three valve 60 H.P.
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NEW YORK

AERIAL AGE
WEEKLY

OL. 14. No. 17 JANUARY 2, 1922 10 CENTS A COPY

The Lincoln Park Yacht Harbor of the Chicago Yacht Club, Photographed by Whitney Speer & Co.

Aeronautical Chamber of Commerce Organized
Review of American Aviation for 1921
Curtiss Wins Hydroaeroplane Suit

UBLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
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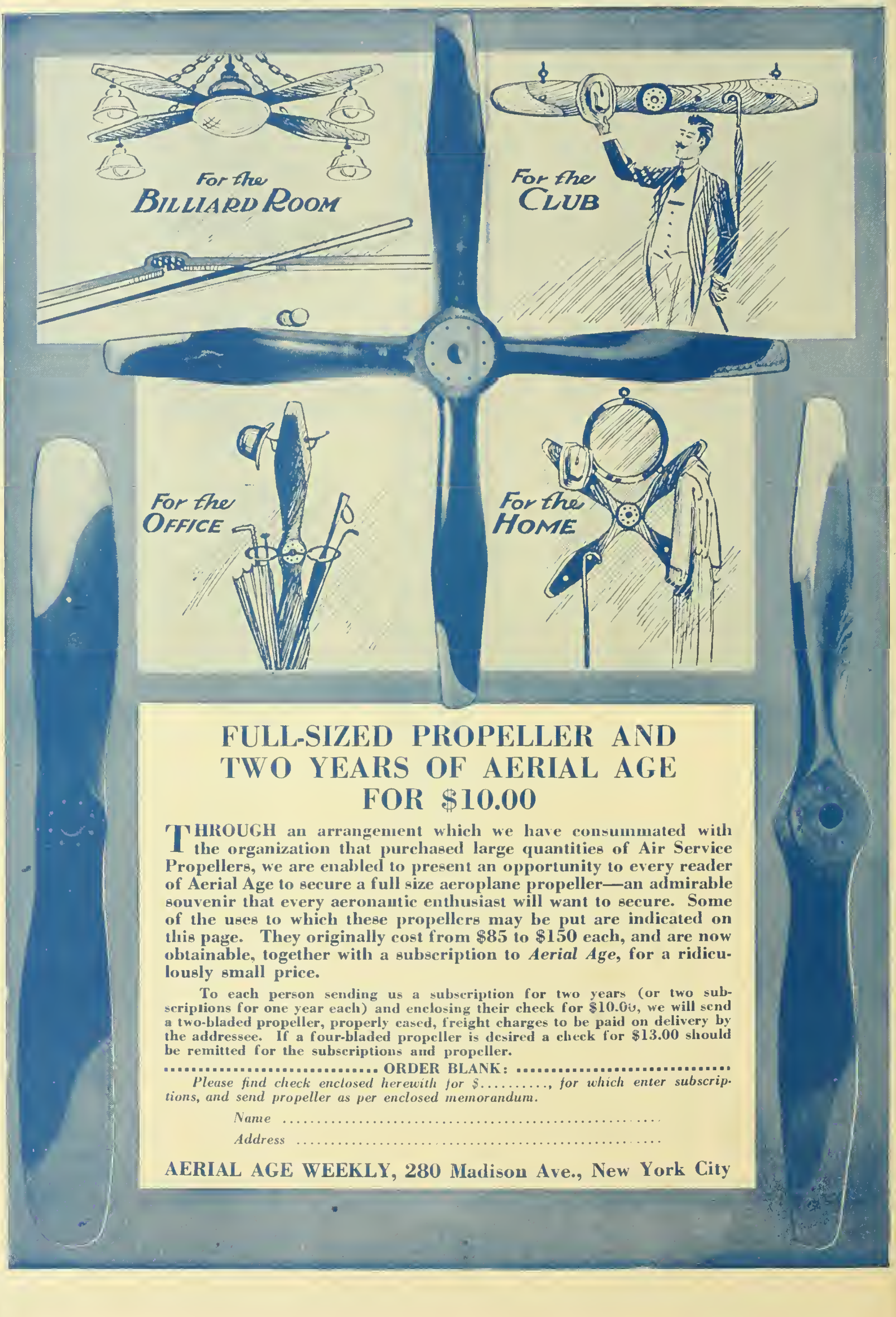

FULL-SIZED PROPELLER AND TWO YEARS OF AERIAL AGE FOR $10.00

THROUGH an arrangement which we have consummated with the organization that purchased large quantities of Air Service Propellers, we are enabled to present an opportunity to every reader of Aerial Age to secure a full size aeroplane propeller—an admirable souvenir that every aeronautic enthusiast will want to secure. Some of the uses to which these propellers may be put are indicated on this page. They originally cost from $85 to $150 each, and are now obtainable, together with a subscription to *Aerial Age*, for a ridiculously small price.

To each person sending us a subscription for two years (or two subscriptions for one year each) and enclosing their check for $10.00, we will send a two-bladed propeller, properly cased, freight charges to be paid on delivery by the addressee. If a four-bladed propeller is desired a check for $13.00 should be remitted for the subscriptions and propeller.

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AERIAL AGE WEEKLY, 280 Madison Ave., New York City

January 2, 1922

AERIAL AGE WEEKLY

VOL. XIV, No. 17

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THE
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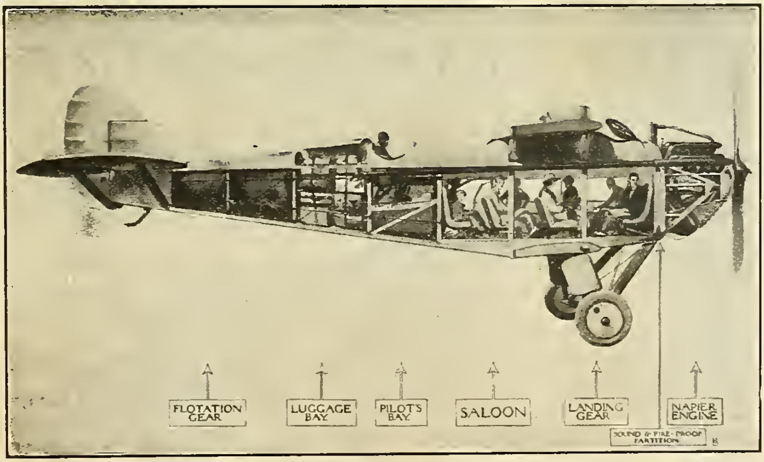

The machine which can transport 8 passengers at a gross cost of **8 cents** each per mile.

IMPORTANT:—By GROSS COST is meant fuel, pilot, insurance, maintenance and depreciation of machine and engine, all overhead charges, and every expense involved in running an air line.

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505 FIFTH AVENUE
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Curtiss

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"CURTISS" NAVY RACER with "CURTISS" CD-12 MOTOR

AMERICAN LEGION CONVENTION, Kansas City
INTERNATIONAL AERO CONGRESS, Omaha
October 31st to November 5th, 1921.

"CURTISS" Firsts — LEGION JUNIOR DERBY—Casey Jones in "C-6 ORIOLE."
LEGION FREE-FOR-ALL—Lloyd Bertaud in "K-12 BALILLA."
PULITZER TROPHY RACE—Bert Acosta in "CURTISS NAVY RACER."
OMAHA 90-MILE RACE—Casey Jones in "C-6 ORIOLE."
OMAHA 75-MILE RACE—F. A. Donaldson in "OX-5 ORIOLE."

"CURTISS" Seconds—PULITZER TROPHY RACE—Clarence Coombs in "CURTISS COX RACER."
OMAHA 90-MILE RACE—N. C. Torstensen in "K-6 ORIOLE."
OMAHA 75-MILE RACE—Casey Jones in "OX-5 ORIOLE."

"CURTISS" Thirds — OMAHA 90-MILE RACE—R. S. Miller in "K-6 ORIOLE."

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Flying

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REVIEW OF AMERICAN AVIATION FOR 1921

CIVILIAN flying in the United States increased 20 per cent in 1921 over the preceding year, according to a review compiled by the Aeronautical Chamber of Commerce for the Department of Commerce. Twelve hundred aircraft were operated by civilians during the last year, flying a total of more than 6,500,000 miles and carrying approximately 275,000 passengers. The figures are based on authenticated reports to the Aeronautical Chamber of Commerce from all sections of the country, and tend to prove that America is holding her own in the air as far as individual effort and accomplishment are concerned.

"In the last twelve months aviation has outgrown romance and is now recognized as practical art," says the review. "The year was crowded with important events, and Government, State, municipal officials and transportation experts are agreed that civilian aeronautics must be developed for peaceful transport and as a reserve arm of the national defense.

"The U. S. Air Mail Service in 1921 made such a record for efficiency on the transcontinental route that it is recognized as a model for civilian aerial transport the world over. Letters have been delivered in New York two days after casual mailing on the Pacific Coast. The service has an average of 88.82 per cent efficiency, that is, completed trips on scheduled time since it was started in May, 1918. The Air Mail has during the last year completed its wireless communications system, the fourteen stations now having radio plants, three operated by the Navy Department and the others by the Air Mail Service. Last February, a continuous flight, with night flying, was made between San Francisco and New York. Mail leaving the Coast at 4:50 p. m. Feb. 22nd, was delivered in New York at 4:50 p. m. Feb. 23rd. U. S. Mail and Curtiss planes delivered to the Coast photographs of the Carpentier-Dempsey fight within 48 hours after leaving.

"Governors of States and heads of Federal bureaus, realizing that fast transport depends upon proper terminal facilities, have started campaigns for the acquisition of municipal landing fields. Ordinances regulating aerial traffic have been passed and enforced in scores of municipalities. Almost all large cities have aerial traffic regulations. State legislatrues and municipalities in passing legislation have made it clear that local regulations are temporary and designed to be suspended by the national code when it is effected. The American Bar Association, Aero Club of America, Aeronautical Chamber of Commerce of America, Manufacturers Aircraft Association and the National Aircraft Underwriters Association, the Society of Automotive Engineers and the National Advisory Committee for Aeronautics have recognized the necessity for a national aerial code. Their views have found expression in the Wadsworth-Hicks Bill now before Congress providing for a Bureau of Civil Aviation in the Department of Commerce. This bureau, among other duties, will have supervision over the licensing and registration of all commercial aircraft and pilots and the enforcement of the laws.

"Among the world's records made during the year in America were those of Lt. J. A. Macready of the Army Air Service, who in September reached an altitude of more than 37,800 feet above Dayton, Ohio, parachute drops of from 22,000 to 25,000 feet made by Lt. A. G. Hamilton and Sergt. Encil Chambers, of the Army Air Service, the closed course speed record made by Bert Acosta in a Curtiss-Navy racer at the Pulitzer Race in Omaha in November when he covered a triangular course of 150 miles at a speed of 176.3 miles an hour—260 feet a second. The Loening Monoplane Flying Yacht carried four passengers to an altitude of 19,500 feet over Port Washington, L. I., in August. A Martin twin motored bomber attained a height of 25,600 feet at Dayton, O.

"Other spectacular performances included the transcontinental flight of Lt. W. D. Coney from San Diego, Cal., to Jacksonville, Fla., 2,180 miles in 22 hours and 27 minutes, the bringing of an army airplane to a dead stop within 15 feet after landing by means of the reversible propeller, the flight of the Aeromarine 'President Zayas' from New York to Havana in 19 hours' flying time, the 4,842 mile flight of the two U. S. Marine Corps planes in charge of Lt. Col. T. C. Turner, from Quantico, Va., to Santo Domingo and return, the 3,200 mile flight of the twelve Navy seaplanes from San Diego, Cal., to Panama. Then there was the feat, repeated four days, of the Army, Navy and Marine Corps planes which flew 100 miles out at sea and dropped tons of explosives on the surrendered German craft in the course of the aerial warfare demonstrations off the Virginia Capes last June and July, which proved conclusively the effectiveness of airplanes in coast defense against surface vessels.

"There were many other accomplishments, less spectacular, but no less important and significant of the rapid develop-

(*Concluded on page* 398)

THE NEWS OF THE WEEK

Experts Indorse Air Bureau Plan

Washington.—Little progress is being made in commercial aviation because there are no governmental agencies for its protection and encouragement, according to army and navy experts who appeared before the Senate Committee on Commerce Dec. 19. They favored the Wadsworth bill which proposes to create a Bureau of Civil Aviation in the Department of Commerce. It provides for the licensing of pilots, taking precautions against accidents, systematizing the flights of commercial planes and the establishment and supervision of routes and landing fields.

Major Gen. Mason Patrick, head of the Army Air Service, said the Wadsworth bill meets with the unqualified approval of his department.

"Should aircraft development reach the proportions the possibilities indicate," said Gen. Patrick, "it would provide the War Department with a trained personnel in case of an emergency, and the plants making the needed planes could be quickly converted into factories for the production of war planes in quantities."

In the opinion of Gen. Patrick, the industry will not assume any considerable proportions until some legislation similar to the pending measure is enacted.

"It will require large investmentts," he said, "and capitalists are shy about investing their money without proper safegaurds."

Replying to a question by Senator Jones of Washington, Gen. Patrick said he did not know of a large organization in New York which is planning to take up the business of commercial aviation next spring on a large scale providing necessary protective legislation is enacted.

Rear Admiral W. A. Moffett, Chief of the United States Navy Bureau of Aeronautics, also supported the proposed measure. He strongly declared his belief that commercial aviation has been given a serious setback because pilots are not licensed. He said they are permitted to carry passengers in obsolete planes, unfit for use, and are allowed to fly over crowds of people.

Plane Saves 12 Stranded

Miami, Fla.—After passing five days without food or water on a reef of the Bahama Islands, twelve men aboard the stranded British motorboat Priscilla have been rescued by a hydroaeroplane of the Aeromarine Airways Company, according to word received here Dec. 18.

Hunting by Aeroplane

Spokane.—The wilderness of central Idaho and its game birds are but three or four hours from Spokane, if you travel as did Del Larson, by aeroplane and automobile. Larson says he obtained the legal limit of blue grouse and was ready to return to Spokane within half a day after he left it. By the ordinary means of travel, meaning train and automobile, the journey alone occupies nearly all of one day.

The flight was made in an airship of the United States Aircraft Corporation, with Lieutenant Nick Mamer as pilot. Leaving Spokane early in the morning a few days ago, they reached Lewiston in time for breakfast. At Lewiston they took passage in an automobile, and were dropping birds by the middle of the forenoon. The following narrative of the adventure is given by Mr. Larson:

"The lieutenant's objective was the Lewiston-Clarkston tristate fair, where he was to do stunt flying, and mine was the forests where nothing broke the silence but the whirl of wings, the crack of gun and the exultant words of the hunters.

"The first grouse was killed soon after we passed Waha lake. From that point to where the road ends bird after bird was dropped. We experienced less trouble in seeing grouse than in finding them after they had been shot, such was the density of the forest.

"Shortly before we reached the end of the road at Zaza Mr. Small asked us not to lok around for a few minutes. When he told us to look we found before us a sight that took our breaths. We were on the edge of a cliff. Below us, thousands of feet, was the river, a powerful rolling stream, while about us was the roughest country I have ever seen. From our positions at the edge of the precipice we could see three states, Idaho, Washington and Oregon. The scenery was well worth the expense and time of a flight by air and another by car."

Early History

Geneva, N. Y.—Evidence that the art of flying was discovered before the days of Langley and the Wright Brothers has been unearthed by a student of Physics in Hobart College, doing research work in the Hobart College Library. In a newspaper of September 11, 1811, the following article was found:

"The art of rising and moving in the air by means of wings, continues to engage the attention of a number of persons in Germany. At Vienna, the watchmaker Degen, aided by a liberal subscription, is occupied in perfecting his discovery. He has recently taken several public flights in the Preter. At Berlin, Claudius, a wealthy manufacturer of oil cloth, is engaged in like pursuits; he rises in the air without difficulty and can move in a direct line, at the rate of four miles an hour, but his wings are unwieldy and he cannot turn around in them. At Ulm, a tailor named Berblinger, announced on the 24th day of April, that he had after great sacrifice of money, labor and time, invented a machine in which he would on the twelfth day rise in the air and fly 12 miles."

Missouri Landing Field

The Henderson-Mauldin Aero Service report the establishment of a landing field 1½ miles east of Fulton, Mo. The field is 2,600 feet long, north and south, and 2,000 feet wide, and is marked by a hangar with circles and wind bag. The field is level, sandy, hard, and dry, and covered with short grass; altitude 800 feet above sea level; prevailing winds north and south.

Obstructions consist of a row of trees along the north fence, scattered trees along the east side, low telephone wires along the south side, and fence and two trees on the west side. Oil and gas on the field; hangar space for two transient planes. Address Mr. Walter F. Henderson or Leslie W. Mauldin for further information.

CALENDAR OF COMING EVENTS
under sanction of
AERO CLUB OF AMERICA

Annual Banquet Aero Club of America
Hotel Commodore, New York City,
7:30 Monday Evening, January 9, 1922
For members (who are entitled to bring guests) of
Aero Club of America, and affiliated Aero Clubs
Society of Automotive Engineers
Automobile Club of America
Automobile Club of New York
Motor Boat Club of America
New York Yacht Club
Tickets: $8.00

April 30th (1 or 2 days)
Spring Show and Opening Meet
Place: Curtiss Field, Mineola, L. I., N. Y.
Conducted by: Curtiss Airplane & Motor Corporation, Garden City, L. I.

September 4th (about) 1-day meet for
Detroit Aerial Water Derby
Curtiss Marine Trophy
Class Race Prizes
Invitation Races
Speed Trophy
Place: Detroit River and Lake St. Clair.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

September 15th (about) 3-day meet
Pulitzer Trophy
Detroit Aerial Derby
for Aviation Country Club of Detroit Trophy and Liberty Engine Builders' Trophy and Class Race Prizes
Invitation Races
Detroit News Aerial Mail Trophy
for Multimotored Aeroplanes Speed Trials
Place: Mt. Clemons Field, Detroit, Mich.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

August 15th (about)
In Preparation by the Aero Club of America
American Elimination Trials, if Necessary for La Coupe Deutsch de la Meurthe (Race to be held in France about October 1st. Place: Mitchel Field, Mineola, L. I., N. Y.

September 30th
First Annual Interservice Championship Meet
Open to the personnel of
The U. S. Army, Navy and Marine Corps Air Service
Championships in Single Seater Fighting Bombing Reconnaissance Races Photography Races Formation Flying, Etc.
Location: Mitchel Field, L. I., N. Y.

August 1st (about)
Foreign Events
Coupe Jacques Schneider
Contest for Flying Boats and Seaplanes
Place: Italy (probably Venice).
Conducted by: Aero Club d'Itali, 24 Via Tor de'Specchi, Rome.
American entries received by the Aero Club of America.

October 1st (about)
Coupe Henry Deutsche De La Meurthe
Race for Aeroplanes
Place: France.
Conducted by: Aero Club of France, 35 Rue François-1, Paris.
American entries received by the Aero Club of America.

The AIRCRAFT TRADE REVIEW

Ralph C. Diggins' Chicago Airmen Traveled 70,270 Miles in Year

The 1921 annual field report of James Curran, Chief Instructor of the Ralph C. Diggins School of Aeronautics, shows remarkable attainment for Chicago airmen. The annual report covers activities of the Diggins' flyers from April up to and as of the closing of business November 30th. The interesting figures show a total of 1,028 hours in the air, a total of 15,000 flights and landings, and nearly 100 students graduated and qualified as pilots during the year. This necessitated 750 hours instruction in the air. Mr. Diggins points out that this is probably a record for aerial instruction never before before accomplished by any school in America.

The cross-country flying included a record breaking trip from New York to Chicago with six passengers and express for Marshall Field & Company, and three other trips to New York and return. Other cross-country flights with the big passenger plane included Indianapolis, Lincoln, Nebr.; Des Moines, Ia.; Cleveland, Ohio. Smaller planes made cross-country flights to West Baden, Ind.; French Lick, Ind.; Louisville, Kentucky, and Des Moines, Ia.; New York, and North Platte, N. D.

It required 9-6 10 gallons of gasoline per hour for the operation of the Diggins' planes for the entire year. This average is arrived at by including all type planes flying under all conditions in the sum total before striking average, so a much lower average would probably be arrived at if individual performances were considered only. This unquestionably proves the economy of flying.

500 aerial photos were taken by the Aerial Photography Department of the Diggins' Aviation Company, most of which were taken in Chicago. However, the aerial mapping of this company included South Bend, Elgin, Aurora, West Baden, French Lick, Ind., and practically all of Chicago suburbs.

It will be remembered that the Diggins' Aviation Company started the year 1921 with practically a total loss by fire which necessitated the re-establishing of the School of Instruction and Transportation Company. Mr. Diggins points out that had he been more fortunate at the beginning of the season he would be telling a different story for this year's accomplishments. He also states that in the future those interested in aviation should stop dwelling on the possibilities of aviation, but rather dwell on the actualities and accomplishments of aviation, stating that during the entire three years establishment of his company, there has not been a single mishap or injury to passenger or student.

Seek Proof Whether Metals Ever Get Tired

The question, "Do metals get tired?" which has puzzled scientists for hundreds of years, is being studied here by a committee of the National Research Council, with the aid of the Board of Engineering Foundation. Scientists say that every once in a while a piece of tempered steel or stout forging will break down without apparent reason.

The solution of the question, engineers say, is awaited eagerly by American aviation experts in the hope of making military flying safe.

North Carolina Seaplane Stations

The following information concerning facilities for the operation of seaplanes at the below mentioned ports has been received from the commandant of the United States naval air station, Pensacola, Fla., under date of November 2, 1921:

SOUTHPORT.—Latitude 33° 55' N., longitude 78° 01' W.

Anchorage.—Good anchorage in depths of 2 to 25 feet. Beach is unsuitable in general for docking planes.

Supplies.—Gasoline may be conveniently obtained from a gas-filling station conspicuously located on the end of a dock. No aviation supplies are available.

Communication.—Telegraph.

MOREHEAD CITY.—Latitude 34° 43' N., longitude 76° 43' W.

Anchorage.—Ample anchorage in Bogue Sound with good holding ground; average depth of water about 6 feet. Shelter may be obtained from winds from all directions. The beach is generally suitable for docking seaplanes.

Supplies.—Gasoline may be conveniently obtained from a gas-filling station. Supplies are available.

Communications. — Telegraph — Navy radio station.

South Carolina Seaplane Stations

The following information concerning facilities for the operation of seaplanes at the port of Charleston has been received from the commandant of the United States naval air station, Pensacola, Fla., under date of November 2, 1921:

CHARLESTON.—Latitude 32° 48' N., longitude 79° 55' W.

Anchorage.—There is ample anchorage room in water varying in depth from a few feet to 40 feet; the beach in general is unsuitable for docking planes. Much drift wood is in the harbor and must be carefully avoided in landing.

Supplies.—Gasoline and oil may be obtained from the Standard Oil Docks across from the north end of Drum Island, or by arranging for boats to carry gas out in drums. The Standard Oil Dock is somewhat high and difficult to approach.

Communication.—Besides the telegraph, there is a commercial radio station in Charleston in addition to the radio station at the navy yard.

Florida Seaplane Stations

The following information concerning facilities for the operation of seaplanes at the below-mentioned ports has been received from the Commandant of the U. S. Naval Air Station, Pensacola, Fla., under date of November 2, 1921:

ST. PETERSBURG.—Latitude 27° 45' N., longitude 82° 38' W.

Anchorage.—There is ample water for anchorage of seaplanes ranging in depth from 1 foot up to 20 feet. Holding ground is good; beach not suitable for beaching planes. There is a sheltered inner harbor in the southern part of the town, but the channel leading to it is somewhat narrow for large seaplanes to maneuver under unfavorable conditions.

Supplies.—Gasoline and oil may be obtained from a wharf in the inner harbor from hose lines, also from the wharf in the outer harbor from tank wagons. There are two private seaplane hangars at St. Petersburg from which minor spare parts and repairs could probably be obtained

Communication.—Telegraph station and Navy Radio station.

MIAMI.—Latitude 25° 46' N., longitude 80° 11' W.

Anchorage.—Good anchorage in depths from 1 foot to 10 feet. A sheltered anchorage can be obtained in the Miami River. Several very shoal spots exist which must be avoided in taking off and landing.

Supplies.—Seaplanes may obtain gasoline and oil from a gasoline dock in the Miami River. The river is quite narrow and somewhat difficult to navigate by large planes in unfavorable winds. Several civilian aviators operate planes at Miami, and it is probable that minor parts and repairs could be obtained from them.

Communications.—Telegraph and Navy Radio station.

TITUSVILLE.—Latitude 28° 36' N., longitude 80° 49' W.

Anchorage.—Shore is unsuitable for beaching planes. Holding ground is good. There is no inner harbor in case of heavy weather, but a lee can be obtained for winds from any direction.

Supplies.—Gasoline and oil may be obtained from the gas-filling station conspicuously located at the end of a dock. The wharf is easily approached from all directions. No aviation supplies are available.

Communication.—Telegraph office open only during the day.

ST AUGUSTINE.—Latitude 29° 54' N., longitude 81° 11' W.

Anchorage.—Beach is unsuitable for docking. Good anchorage exists in sheltered waters with good holding ground.

Supplies.—Gasoline and oil may be obtained from boats. So far as is known no aviation supplies are obtainable.

Communication.—Telegraph.

FERNANDINA.—Latitude 30° 40' N., longitude 81° 28' W.

Anchorage.—No suitable beach for docking planes. Available anchorage space has a depth of 30 to 60 feet. Ample room for taking off in all directions may be had by taxi-ing a short distance.

Supplies.—There are two gas-filling docks from which gasoline and oil may be obtained. The directions of approach to the docks is limited and might cause embarrassment in unfavorable weather. No aviation supplies are available.

Communication.—Telegraph, not open after 6 p. m.

UNITED STATES COURT DECIDES GLENN H. CURTISS INVENTED HYDROAIRPLANE

THE United States Circuit Court of Appeals of the Second District on December 15, 1921, reversed the decision of the United States District Court of the Eastern District of New York and held that Glenn H. Curtiss was the first person to invent and operate a successful and practical hydroaeroplane or flying boat and has awarded him the broad patent thereon. The decision is final.

The decision is regarded as one of the most significant developments in aviation since the adjudication of the Wright patents, as it serves notice to the world that credit must go to the United States, not only for the first practical flights by machine-propelled aircraft from the ground and back to the ground, but from the water and back to the water, as well.

Justices Merrill Hough, Martin T. Manton and Julius M. Mayer were on the bench, Judge Hough writing the opinion. The decision was rendered specifically against patent No. 1,312,910, which was issued to Albert S. Janin, of Staten Island, on August 12th, 1919, and which has been the subject of controversy in the Patent Office and the courts since 1913.

After the Wright Brothers successfully demonstrated mechanical flight, the next obvious step in realizing full dominion of the air was to construct and operate an aeroplane capable of taking off from and alighting on the water. Glenn H. Curtiss had been working on this idea as far back as 1908. So, too, had individuals in Europe, the most prominent of whom was the Frenchman Fabre, who in 1910 succeeded in getting off the water with a "tripod" gear, but failed in landing, repeatedly wrecking his machine, including his final attempt. The court has held that Mr. Curtiss has been shown to have been the first man in the world to successfully arise from and alight upon the water. A situation of international importance is thus created.

Mr. Curtiss' work was carried on at his plant at Hammondsport, N. Y., as early as 1910, when preparing for the flight down the Hudson from Albany to New York, he had successfully alighted upon the water by means of pontoons attached to his landing gear. In the same year, 1910, he operated his first primitive canoe or boat-like structure of a hydroaeroplane on the surface of the water.

In 1911 he built and successfully operated the world's first flying boat. On January 24th, 25th, and 26th, 1911, in the San Diego, Calif., harbor, he took off from and alighted on the water. His flights on January 26th were publicly announced and witnessed by newspaper men and recorded in the press.

On August 22nd, 1911, Mr. Curtiss filed application for a patent on the boat hull structure which has since been demonstrated and is now legally and finally recognized as the basis of all subsequent marine flying developments throughout the world.

On January 26th, 1911, the very day that Mr. Curtiss' flights were being publicly observed in San Diego, Albert S. Janin filed application for a so-called land, water, and air machine.

On July 31st, 1913, Janin filed a subsequent application substituting for the previous application, but retaining the date of the first. It was alleged that new and different drawings were offered which rendered the first application inoperative. It was further alleged that the last application concealed features upon which the first claim was based.

When Mr. Curtiss made application on August 22nd, 1911, interference was declared with the prior application of Mr. Janin, but the Examiner decided in favor of Mr. Curtiss. The Board of Examiners in Chief reversed the ruling in favor of Janin and the Commissioner of Patents in turn reversed it in favor of Curtiss. Janin carried the case to the Court of Appeals, of the District of Columbia, and won the decision by a majority of the court, after which Janin's patent was issued.

Mr. Curtiss then took the fight into the U. S. District Court to compel the Commissioner of Patents to grant him a patent for the invention. Judge Chatfield in 1919 dismissed the bill, holding that Janin was entitled to the invention.

Another appeal was taken by Mr. Curtiss to the United States Circuit Court of Appeals of the Second District, and the District Court was reversed.

Judge Hough in his decision, declares the fundamental point to be whether Janin, in his original application, of January 26th, 1911, disclosed an operative hydroaeroplane or flying boat and then answered this in the negative. "Decision both in the District Court of Appeals and the Lower Court," reads the decision, "has rested on Janin's 'unchallenged reduction to practice of January 26th, 1911.' It seems to have gone unchallenged in the interference, argument was rested on Curtiss' earlier achievements in 1910; in this case it is successfully challenged, and we find that Janin reduced nothing to practice, because what he conceived and disclosed is, as an hydroaeroplane, wholly inoperative, for it can not get out of the water;——the rest is immaterial. Decision is grounded on this point; though we may say further, that in view of the proven unreliability of Janin and his witnesses, we think no reduction or conception can be assigned him earlier than January 26th, 1911, in which case Curtiss antedated him by at least two days."

One of the interesting features of the evidence produced at the trial was a sketch presented by Janin and claimed by him to have been made in 1899 when he was a carpenter lad of 19. This sketch illustrated a hydroaeroplane having many modern features, including the now famous Wright invention on the ailerons and the Joy-Stick control and other modern features invented years afterward by famous aeronautical engineers.

Mr. C. M. Keys, President of the Curtiss Aeroplane & Motor Corporation, made the following statement:

"The decision in the Janin case is no surprise to me. The Board of Directors ordered the appeal to be made only after a thorough study of the evidence had made it quite clear that the rights to this invention lay with Curtiss. We are of course, gratified that the court has sustained that opinion.

"It is timely perhaps to state at this time the policy of the Curtiss Company with respect to the patents which it owns. The company in the past has had a definite policy to use its patents only as a manufacturing company, and has, perhaps, paid too little attention to the general use of these patents by others. The plane patents are, of course, made available to the major part of the industry as a whole under a cross license agreement which grants the right to use these patents to all members of the Manufacturers Aircraft Association on the payment of a fixed royalty for these patents, as well as the patents owned by others. The Curtiss Company owns, in all, some 200 patents covering both planes and motors. A few of them are, if they are sound patents, basic in their character; others are controlling patents in tht manufacture of planes and motors as at present carried on; while still others are detail patents of some importance; and many, as is natural in a new industry, cover details of design and practice which have already become obsolete.

"Full study of these patents has been going on since September, 1920. This survey began because it was seriously intended to liquidate the Curtiss Company in case it was impossible to obtain relief from some of the burdens imposed upon the company during the war, as a result of the war. It is necessary therefore to know pretty definitely what a trustee for these patents in liquidation might reasonably hope to find them worth. As a result of this survey, we know pretty definitely what we have.

"A thoroughly definite policy has been laid down by the Board of Directors with respect to these patents. When competent engineers and counsel tell the company that certain specific patents are worth protecting, they must be protected, just as any other property belonging to the stockholders of the company is protected.

"In establishing this policy, however, the company has in mind that it will, unless its rights are flagrantly invaded, make every effort not to interfere with the carrying on of experimental and research work in the aeronautical art. In this respect the policy of the company is identical with the policy of Glenn H. Curtiss before the company was organized and has been the policy of the company since its organization.

"We also must recognize that a somewhat free and casual use of other people's patents is natural enough in a new art. I do not believe that there is any widespread conscious intent in the aeronautical industry to appreciate without payment a property belonging to other people.

"We do not intend any wholesale litigation, but we are quite willing, should it be necessary, to test in the courts some of the more important Curtiss patents."

The particular claim that was framed by the Examiner in the Patent Office as the basis for the interference between Janin and Curtiss to determine the question of priority between them, is as follows:

"A hydro-aero-machine comprising a main aeroplane supporting surface, lateral stabilizing aeroplane surfaces to create a difference of lift, a main water-borne central boat structure adapted to support the entire machine when on the water, and except for the aeroplane lift, constituting substantially the entire supporting element at all speeds so long as the boat structure is traveling in contact with the water, relatively small horizontal water balancing floats located below the supporting plane and beyond each side of said boat structure, said floats being located above the level of the boat bottom and provided with surfaces inclined downwardly and rearwardly, adapted to be acted upon by the rush of water when the machine loses its lateral equilibrium, and means for operating the stabilizing surfaces to create a difference of air lift."

There are, however, many other claims that have been made, and that have been allowed, and which will now go to Curtiss. Some of these claims, for example, are as follows:

"A heavier-than-air flying machine having an aeroplane, and a water-borne structure adapted except for the aeroplane lift to be substantially the entire supporting element of the machine at all speeds on the water, said machine having in the direction of each lateral end thereof a surface extending toward the water and adapted to be acted upon by the rush of water as the machine loses its lateral equilibrium.

"A hydro-aero-machine having a main aeroplane supporting surface, a water-borne central boat structure adapted to support the entire machine when on the water, and except for the aeroplane lift, constituting substantially the entire supporting element at all speeds so long as the boat structure is traveling in contact with the water, and lateral water stabilizing surfaces to create a difference of lift.

'In the machine adapted to be supported jointly by air and water while running on the water, an aeroplane adapted to be acted on by the air to exert a lifting effect, a centrally positioned floating means below the aeroplane adapted to support substantially the whole machine when at rest on the water and, except for the lift of said aeroplane, constituting substantially the entire supporting element so long as the machine is traveling in contact with the water, a relatively small float provided with a hydro-surface positioned in the direction of the lateral end of the aeroplane, and adapted to automatically balance the machine when either side becomes depressed.

"In a machine of the character described, an aeroplane adapted to support the whole machine in the air, lateral stabilizing surfaces to create a difference of air lift, a buoyant structure adapted to support the entire machine when at rest on the water and except for the lift of said aeroplane constituting substantially the sole supporting element so long as said machine is traveling in contact with the water, said buoyant structure having an upwardly inclined forward hydro-surface acted on by the rush of water and a substantially flat bottom, said aeroplane being so attached to said buoyant structure that when it is speeding in contact with the water said aeroplane is maintained at substantially a flying angle of incidence, whereby the machine rises to the top of the water and the head resistance of the water is decreased, and a propeller operating on the air to drive the whole machine forward until the air lift on said aeroplane raises the machine out of the water."

It will be observed that the last claim, which is one of the claims previously granted to Janin, brings in specifically the shape of the boat bottom in the operation of the machine on the water, but makes no reference to maintaining the lateral balance by the lateral water-acting floats.

"A heavier-than-air flying machine having an aeroplane a main water-borne structure adapted to travel in contact with and be supported by the water and constituting substantially the entire supporting element when the machine is speeding in contact with the water, an inclined hydro-surface toward each lateral end of the aeroplane and acted on by the rush of water, said aeroplane having a movable surface at each side under control of the operator to create a difference of air lift whereby the operator may depress either side of the machine when traveling in contact with the water and thereby force the hydro-surface on that side deeper into the water to create a drag on that side of the machine to aid in steering the same and correspondingly raise the hydro-surface on the elevated side so that it is substantially out of the water before the wing tip on the depressed side comes in contact with the water.

"A heavier-than-air flying machine having an aeroplane surface and a centralized water-borne structure adapted to support the machine on the water and except for the aero lift being substantially the entire support at all speeds, said machine having in the direction of each lateral end thereof, a downwardly and rearwardly inclined narrow hydro-surface extending toward the water and adapted to be acted upon by the rush of the water as the machine loses its equilibrium."

S. Mortimer Ward, Jr., of the firm of Ward, Crosby and Smith, patent counsel for the Curtiss Company, in charge of this suit, states that in lay language, it may be said that the patent that will now be issued to the Curtiss Aeroplane and Motor Corporation, upon the invention of Glenn H. Curtiss, patent for which was formerly granted to Albert S. Janin, will cover in one aspect, a hydroaeroplane, whether of the flying boat or pontoon type, having a main water-borne structure capable of hydroplaning and supporting substantially the entire machine upon the water, said structure being so related to the wings of the craft as to enable the craft to be driven at hydroplaning speed upon the water and successfully flown from and back to the water, and with balancing means arranged laterally with respect to the water-borne structure, for engagement with the water, to maintain lateral balance of the machine during operation on the water.

Aircraft Industry Organizes Chamber of Commerce to Popularize Travel by Air

New York, Dec. 30.—Organization of the aircraft industry into a national body known as the Aeronautical Chamber of Commerce of America, with approximately 100 charter or founder members embracing the designing, constructing, operating and kindred elements, and representing virtually every section of the United States, was announced today at the Executive Offices, 501 Fifth Avenue. Among other things, it will develop the market and increase the use of flying machines among civilians, corporations and transportation companies.

The aircraft industry thus follows the example of all other modern industries which owe their present greatness in no small measure to the trade association. Organization of the Aeronautical Chamber of Commerce, following as it does the creation of the Bureau of Aeronautics in the Navy Department, and provision, in the Wadsworth-Hicks Bill, for a Commissioner of Civil Aviation in the Department of Commerce, and the nationalization and extension of the Aero Club of America, completes the accomplishments for the year and establishes the machinery whereby, it is believed, the development of American aviation will be greatly hastened.

The Aeronautical Chamber of Commerce of America is incorporated under the laws of the State of New York. Among its aims and purposes, as set forth in the Charter, are:

To foster, advance, promulgate, and promote trade and commerce, throughout the United States, its territories, possessions, and in foreign countries, in the interests of those persons, firms or corporations engaged in the business of manufacturing, buying, selling and dealing in aircraft, aircraft motors, and aircraft parts and accessories of every kind and nature.

To diffuse among its members accurate and reliable information as to the standing of its members and those persons, firms or corporations engaged in similar lines of business.

To procure uniformity and certainty in the customs and usages of trade and commerce among its members and those persons, firms or corporations having a common trade, business or professional interest in all matters pertaining to aeronautics.

To aid and assist in mapping out air roads and lanes; the location of landing fields, airdromes, hangars, or such other structures as may be necessary for the advancement of aeronautics.

To advocate and promote in every lawful way the enactment of just and equitable laws . . . pertaining to aeronautics.

To settle, adjust and arbitrate any and all differences which may arise between its members, and persons, firms or corporations dealing with them.

To promote a more enlarged and friendly intercourse between its members, persons, firms and corporations engaged in the business of, or dealing in, aircraft, aircraft motors and aircraft parts and accessories, and generally to do every act and thing which may be necessary and proper for the advancement of the aeronautical art and industry and the accomplishment of the objects and purposes hereinbefore set forth; provided, however, that nothing herein contained shall authorize this corporation to engage in any business for pecuniary profit.

Complete details of this important new aeronautic organization will be given in our next issue.

STANDARDIZATION AND AERODYNAMICS

By **PROF. VON KARMAN**

University of Aachen. (Germany)

Introductory Note

The suggestions offered by W. Knight in the Aerial Age of June 20th, 1921, as to the desirability of calling a conference in the United States among representatives of leading aeronautical scientific organizations with a view of reaching an international agreement on the subject of Standardization and Aerodynamics was taken up by Prof. L. Prandt of the University of Göttingen, Germany, and in the October 3rd issue of the Aerial Age his views on this matter were given. Prof. Dr. von Karman of the University of Aachen, a most brilliant scientist who has been prominent in the development of aeronautics in Austria during the war and who is now at the head of the Aachen aerodynamic laboratory, writes to Mr. Knight the following letter and gives his views on "Standardization and Aerodynamics" which are presented to the readers of the Aerial Age.

Dear Mr. Knight,—

I am sending you herewith attached a few notes giving my views on the very important point that you have recently raised in the Aerial Age on the subject of Standardization and Aerodynamics, which you may publish if you think it worth while.

There is no doubt that if you can succeed in bringing together former allied and former enemy scientists for discussing a problem which interests everybody, you shall have greatly contributed to the scientific development of aerodynamics.

In my opinion it should be desirable, to begin with, to have a preliminary conference between a few of the most prominent scientists and technical men interested in this matter for discussing the best means for creating an international scientific aeronautical association which is the best suited for bringing about a much desirable cooperation among aerodynamical research workers.

I think that an association organized along the same general lines as the International Society for testing materials shall admirably serve our purposes.

This preliminary conference that I am suggesting for laying the foundation of a permanent international scientific aeronautical association should be desirable if it took place in Europe, in some place having an international character, and I suggest for this purpose the southern Tyrol (Italian Tyrol), at Bozen or Meran.

Yours very cordially,

von Karman.

Professor von Karman's Suggestions

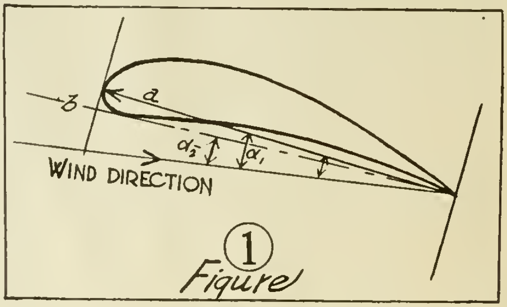
In its early stages a new science labors under the advantage of the possibility of having its development directed from the beginning in an orderly and systematic manner. The primary requirement to this end is the international standardization of definitions and symbols, and it would be of great value to aerodynamics if America were to take the lead in this matter. The most important problems that should be taken up in such an undertaking, in the writer's opinion, are the following:

1. *Standardization of Coefficients.*

The standardization of nomenclature and derivation of coefficients is not a purely objective matter, as it is based upon a thorough understanding of the theoretical foundations of aerodynamics. In spite of the apparent simplicity of the French system, I believe that preference should be accorded to "abstract" coefficients, independent of dimensions, as the laws of mechanical similarity are more clearly evident by their use. Ever since the importance of Reynold's index has been clearly recognized, most laws of resistance can only be applied when this number is contained as a parameter, in which cases the use of abstract coefficients is evident. Many complicated phenomena, such as surface friction or heat-transference in turbulent gases and liquids, would have been explained much sooner if early investigators had expressed their results by empirical formulas in terms of concrete entities and abstract coefficients.

2. *Standardization in Methods of Measurement.*

For the correct *measurement of air-speed* it is essential to establish standard methods, if results obtained in different laboratories are to be compared with safety. Measuring instruments such as the Pitot tube, should be standardized as to shape with the eventual selection of a "standard" at some central point for comparative reference. Unfortunately (as expressed in the article by H. Prandtl in the issue of Oct. 3rd, 1921), the speed thus measured is not a true expression, depending, as it does, on the magnitude of the vibrations or the so-called *degree of turbulence.* It would be a thankful task for a laboratory to build apparatus for the determination of these factors. Meanwhile it would seem advisable to follow the suggestion of Mr. W. Knight to have a few simple bodies experimented with in *all* important laboratories and have the results thus obtained compared and reduced to a common proportionate expression.



Thus it would be possible to determine accurately the resistance of a circular disc or a sphere of a given diameter and adopt that dimension as a standard. In fact, in view of our limited knowledge of the influence of surface conditions or unavoidable variations in the making of similar models it would be best to have the same model make a round trip to every laboratory adapted for such work.

3. *Standardization of Definitions and Symbols.*

Next to the standardization of coefficients and their relationships an agreement should be reached as to definitions and symbols. For example, take the definition of Angle of Incidence, which in Austria and England is defined as the angle between the direction of the air-stream and the so-called maximum chord (a) (in fig. 1) while in other countries the lower tangent to the profile passing through the trailing edge is taken as a basis. (b) Many other elements can be conceived in different ways and are therefore of doubtful interpretation. In speaking of wing-surface and wing-loading it is undetermined to what extent ailerons can be assumed to be part of the carrying surface, or in the case of strong dihedrals whether the surface itself or its horizontal equivalent is to be taken as a basis of calculation. In this case even the meaning of the word "span" becomes subject to misinterpretation. Aspect ratio, which plays such an important part in modern wing-theory, becomes an inderterminate quantity when applied to diminishing chords. To afford a useful basis for description and comparison of aircraft it is imperative that all such elements be defined without possibility of misunderstanding.

A similar divergence in methods applies to the determination of efficiencies. The efficiency of a propeller has been defined by three or four scientifically justifiable expressions, and nevertheless we often read the old $\frac{\text{traction}}{\text{Horsepower}}$ formula, which is in no way characteristic of the efficiency of a screw as it takes neither speed nor dimensions into consideration.

From the above random examples we see that a comparison of opinions and a sifting of various methods now in use would bear good fruit. An *immediate* understanding on work in course of preparation or contemplated would result in the avoidance of duplication and would insure that every experiment be undertaken in the laboratory already best equipped to carry on its particular share of the work. The activities of the International Association for Testing Materials, which in pre-war days co-related and assisted in preparing the results obtained in all laboratories, could well serve as an example. If such activities could be extended towards the practical side of aircraft design, as for instance in the comparison and standardization of methods of calculation, determination of factors of safety, etc., a magnificent program could be outlined, the realization of which will be of maximal importance to the further development of the science of flight.

THE CURTISS-NAVY RACER

THE Curtiss Navy Racer was built during 1921 on Navy order, for the purpose of using it in such contests as the Pulitzer Trophy Race, with the idea that motors and aeroplanes in competition contribute greatly to the knowledge of the air services with regard to the possibility of their use for military purposes, and due to the fact that when engineers go about to conceive and produce a racing type of machine, they generally make considerable advances in the art useful for military pursuit types.

The Curtiss Navy Racer is a biplane of 22′ 8″ span, 21′ .5″ length, and 8′ 11″ height. It has a total supporting area of 168 sq. ft., and a full load weight of 2,165 ℔. The power plant is a Curtiss CD-12 engine of 400 b.h.p. This motor is especially suited to small high-powered ships of the pursuit type on account of its light weight, small size and the ease with which it can be streamlined into the structure.

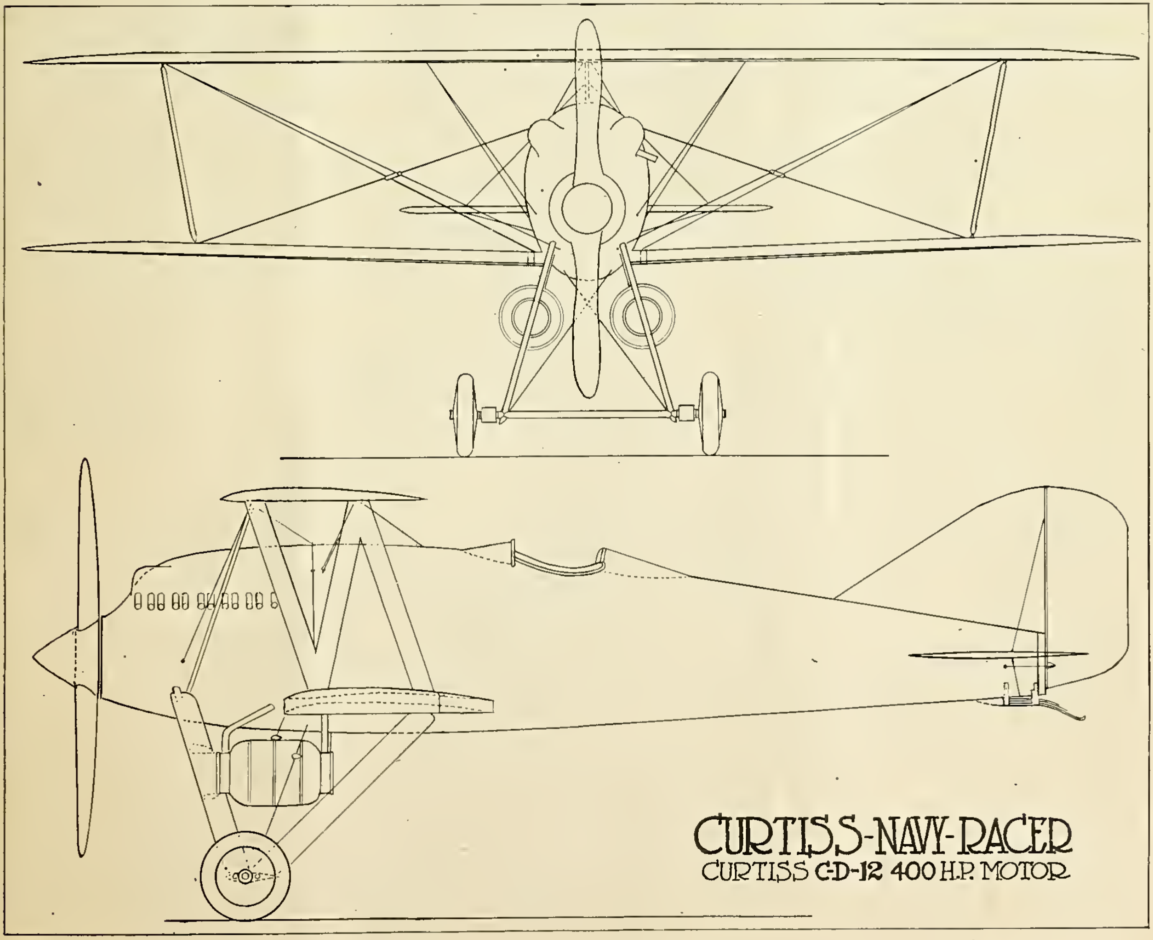
Contract was let for the construction of two machines about the first of June, 1921, and one machine was completed ready to fly on August 1, 1921; another machine exactly similar, was finished August 8, 1921. These machines were first flown early in August, with Bert Acosta as pilot, at the Curtiss Field, Mineola. The flight tests were made by Mr. Bert Acosta and Lieut. Bradley, of the U. S. Marine Corps, during August and September and the early part of October. When it was definitely decided that the Navy and Army Air Services would not compete for the Pulitzer Trophy in the race at Omaha, the Curtiss Aeroplane & Motor Corporation requested the loan of one of the Navy Racers for the competition, which loan was granted by the Navy Department.

In developing the design of the Curtiss Navy Racer, nothing radical was attempted, as the Curtiss Company and the Bureau of Aeronautics of the Navy believe greater progress in the art and industry can be attained in the developing of high speed machines by maintaining factors of safety suitable for military pursuit ships with maneuverability and landing speeds that will permit the ship to be flown from and landed in an ordinarily good flying field.

The Curtiss Navy Racer maintained a speed of 176.7 m.p.h. over a triangular course of 30.7 miles for a distance of 153.59 miles, which is a world's record.

Following are some general specifications of the Curtiss Navy Racer:

Span	22′ 8″
Length	21′ .5″
Height	8′ 11″
Chord	48″
Gap	48″
Stagger	15″
Tread	60″
Factor of Safety of Wings	9
Motor, Curtiss CD-12	400 hp.
Gas Consumption	.5 ℔ per h.p. hr.
Oil Consumption	.015 ℔ per h.p. hr.



AERONAUTIC LESSONS FROM EUROPE

By RALPH UPSON.*

In going back and forth between Europe and America, I have discovered a very curious bit of psychology. In this country it seems to be the style, among those aeronautically inclined, to hold Europe up as a model, to call particular attention to her selected successes in commercial aviation, her government subsidies, her published statistics, with exhortation to the United States to go and do likewise. But when I get to Europe I find precisely the same attitude with respect to us. "Watch America," they say, "she is really doing things. Look at the huge number of passengers carried in the last year, the success of the aerial mail, the organization of a big airship company."

Suppose we follow through along this line:—We copy Europe, Europe copies us. Where do we get? Where does anyone get by mere copying? We have our own conditions, and our own problems to solve, for each of which there is only one best solution. We have capable men and adequate facilities, with a volume of high grade traffic and a valuation of time unexampled anywhere else in the world.

Taking aeronautics as a whole, the possibilities in America are far more encouraging than in Europe. A study of European developments cannot help but be of great value, but we must use the lessons gained as a help in working out our own plans, not as a substitute for them.

Now that we have cleared the air a little, let us see what has really happened in Europe. There is no use going back further than the end of the war. During the first few months of peace, great numbers of aircraft of all different sizes were dumped, scrapped or otherwise disposed of. Airplanes were literally as cheap as dirt. As business was still generally good it was a great incentive to try and use some of these planes and accessory equipment for commercial purposes.

To accomplish anything it was first necessary to give aviation some kind of a legal status, especially for international service. So the allied nations got together and framed up a most valuable code covering rights and duties of operators, responsibilities to the public, requirements for safety, etc., which is the basis for everything that has since been done in Europe. America does not share any benefits of this work because it was dimly related to the League of Nations.

Commercial flying was well started within a year after the armistice; but the operating companies soon found that they were losing money, in spite of the fact that they were getting their planes and terminal facilities practically for nothing. We now know the reason; that the average war plane was a poor investment for commercial use *even when accepted as a gift.*

At that time the most obvious solution of the financial difficulty was government subsidy. France led the way with very liberal subsidies, and it must be admitted that aviation in France today is in a very flourishing condition, as far as the actual operating companies are concerned. But I do not feel that the French got far enough with the unsubsidized industry to really give it a good trial. Experience from England is more enlightening in this respect.

The English cross-channel service was started in the spring of 1919 by the Airco & Handley-Page Companies. Both used made-over war machines, but as far as the passenger accommodations were concerned they were carefully redesigned. They ran for a little over a year, not making any profits, but also not losing much. The fare from London to Paris, reduced to American units, was about $42. In the spring of 1920 they were beginning to realize that merchandise was a great deal cheaper to haul, pound for pound, than passengers. So, in a last attempt to produce profits, the express rates were reduced and the passenger fares raised. In the meantime the competition of the subsidized French lines was getting very serious, resulting in a substantial reduction of both passenger and express rates.

The condition of the British lines came quickly to a crisis. Mr. Holt-Thomas, the head of the Airco system, withdrew from the field. He wrote me soon afterwards that he was far from discouraged about the future of aviation but that under existing conditions he simply could not make it pay. He claimed the principal trouble was that the traffic was not big enough; that they could make sure profits even on the lower rates if they could get more volume of business, partcularly merchandise. But people were not yet educated to appreciate the value of fast transpor-

The Handley-Page Co. soon after got assurance of government support and continued to operate. The Instone Air Line was organized on a basis of similar promises and took over what was left of the Airco business. Thus England entered the regular subsidy class.

Today both French and English lines operate between Paris and London on a fare of $21, which is not quite double the first class fare by train and boat. Government subsidy has been accepted as a practical necessity by nearly every country in Europe. In France, in a little over a year's time, passengers carried increased 2½ times, merchandise 3 times and mail 4 times. Several of the companies have run through the whole season without a single accident. The regularity also has been surprisingly good. Let me give you an example: On September 18, the day of the International Balloon Race from Brussels, we started up in a wind of over 30 miles per hour, and the worst kind of general weather conditions. After landing, two days later, I learned that with the exception of the balloons, not a single aircraft had been able to cross the Channel that day. *But it was the first time since March that the service had been so completely suspended.*

Air lines are now branching out to every important point in Europe. Here is a time table, for example, that gives full information for all lines originating in France. A regular schedule is maintained from Toulouse, France, to Cassablanca, on the west coast of Morocco, a straight line distance of nearly 900 miles, and an airship line is to be started next spring.

But with all this encouraging development it does not seem thoroughly sound. The statistics are all right, but statistics cannot tell the whole story. To speak plainly "there is something rotten in Denmark," and in every other country for that matter. The fundamental fault is that the subsidy is granted almost entirely for military reasons. For the most part it is essentially a premium on mere operation. Where new designs are encouraged, stress is put on the military features. It is an inherently vicious system because it is self perpetuating, by discouraging the only kind of development that can put aviation on its own feet. In this I am not trying to criticize European methods which have been conspicuously successful for the purpose intended. But the American people have a very just suspicion of any kind of direct subsidy. Not only that but I think I voice the majority opinion of aircraft men themselves by saying that we do not need and do not want any subsidy for the operation of aircraft in America. With all due respect to the steamship companies, we do not want an industry that has to be continually drugged to keep it alive. If that is the kind of business we are pushing, it does not deserve any help.

But is there anyone now so pessimistic as not to believe in the future of aviation? I do not feel that it is necessary at this late day for me to take up your time simply arguing the importance of aviation. Let us be done with merely asking and answering the same old question, "Will aviation be worth while?" That question is absolutely settled; it will be worth while, and all we need to do is to go out and make it so. I say "we" in a broad sense to include, of course, our own government. We may very well feel that some of the foreign governments are too paternalistic, but that does not mean that we should sit and do nothing. How could our railroads ever have developed without government co-operation? We can at least do as much for aviation.

I need hardly mention the main essentials, on which everyone seems to be in agreement. Some form of central governmental bureau for civilian aeronautics, such as provided for in the Wadsworth-Hicks bill, is the most natural starting point. Public confidence, safety of operation, the financing of new undertakings, the lay-out of routes and a proper basis for insurance will all be much facilitated by proper government co-operation.

But while we are justly concerned with the means and methods for promoting the use of aircraft, we must not forget the main purpose, the big idea. Let other nations back commercial aviation for its military value. If we can only develop its real commercial value, the other will take care of itself; for a self supporting, going industry, which is an economic asset to the country, is the best military asset as well. To attain this, the most serious problems are the technical ones, mainly involved in the design of the machines themselves.

I will close with a very definite suggestion. France is spending $2,500,000 per year on aircraft subsidies, which shows every indication of being perpetual. Let our government set aside, once and for all, one fifth of this amount that France spends in a single year. Divide it up into a series of prizes for the best new designs to accomplish the following objects, respectively:

1. Safety for passengers.
2. Economy for merchandise and mail.
3. Night flying.

If this is done properly, there is every reason to believe that the personal risk can be cut down to one-twentieth of its present value, little though it now is; that mail can be carried for a cost per pound of one-thirtieth the present cost, successful though our air mail already is; that aerial transportation will open up a great new field of its own, not to the injury of present transportation systems, but supplementing them to the great advantage of the whole public.

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* Speech delivered before the Metropolitan Section S. A. E.

AERO CLUB OF AMERICA COMMITTEES

The following constitute the committees of the Aero Club of America for the fiscal year, November, 1921, to November, 1922:

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Augustus Post

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President, Benedict Crowell; 1st Vice-President, Chas. Jerome Edwards; 2nd Vice-President, James A. Blair, Jr.; 3rd Vice-President, Godfrey L. Cabot; 4th Vice-President, F. Trubee Davison; Treasurer, Philip, J. Roosevelt; Executive Secretary, Harold E. Hartney; Recording Secretary, Augustus Post.

The Governors are:

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SUPPLEMENTARY REPORT ON EXPERIMENTAL REINFORCED PLYWOOD TRUSS RIBS

Since the writing of the original report on "Experimental Reinforced Plywood Truss Ribs" considerable progress has been made in the development of reinforced plywood truss ribs with reinforcing on only one side of the web. This type of construction is obviously a great deal better adapted to production than the former. The results of our investigation prove that the economy in production is accompanied by but a slight increase in weight.

The design data was the same as that upon which the original ribs were based and is tabulated in Table V. The fixity coefficient of the web members was modified as follows: Two in the plane of the truss, and 1.25 in a plane perpendicular to the plane of the truss.

The material was the same as used in the original ribs consisting of 3/16 inch spruce-poplar plywood with the spruce face plies horizontal. The plies were of equal thickness. The cap strip and web reinforcing strips were spruce.

It was considered advisable to adapt the Warren truss type of construction with the diagonals adjacent to the spars taking compression. The outline of the truss is the same as for ribs 1 and 2 of the original design. The direct stresses, and the bending moments in the chords will be the same consequently, and are tabulated in Table VI under ribs 595-1 and 2.

Design of Web Members

The web members consisted of a strip of plywood to which was glued a spruce reinforcing strip. The stress was applied through the plywood at the extremities of the web members and transmitted to the reinforcing strips through the glued surface. Sufficient gluing surface was provided to develop the reinforcing strips. The design of the web members was at first based on the direct stresses only, but it was found in the test that the effect of the eccentric application of the load could not be ignored. Therefore, the design of the web members was changed and the compression members were designed by the method of secondary deflections. The heavily stressed compression diagonals adjacent to the spars could not be designed economically with reinforcing strips on one side, so it was thought advisable to reinforce these two members with strips on both sides. The other compression web members, however, were analyzed as columns eccentrically loaded by the method of secondary deflections and the design proved very satisfactory. To illustrate its application the design of member 5-6 will be worked out in detail.

Member 5-6. Vertical web member:

Stress = —223 pounds.
Length = 18.85 inches.
Effectiveness of plywood = 0.435 referred to spruce.
Effective area = 0.2436 square inches.
$X_{c.g.} = 0.358$ in.
$I_{c.g.} = 0.00926$ in.^{4}
$r = 0.195$ in.

The primary eccentricity is equal to the sum of the initial eccentricity in the member which is equal to the distance from the center of the plywood to the center of gravity of the section, and the deflection due to the load.

$$\text{Primary deflection} = (X_{c.g} - 3/32) + \frac{ML^2}{8EI}$$

$$= (0.358 - 0.094) + \frac{223 \times 0.264 \times 18.85^2}{8 \times 1{,}600{,}000 \times 0.00926} = 0.440 \text{ in.}$$

Primary bending moment $= 223 \times 0.440 = 98.2$ in. lbs.

The next step is to determine the uniform load which will produce the same bending moment at the center of a beam freely supported at the ends.

$$98.2 = \frac{wL^2}{8};\ w = 2.21 \text{ lbs. per linear inch.}$$

$$\text{Deflection due to uniform load} = \frac{5}{384}\ \frac{wL^4}{EI}$$

$$= \frac{5}{384} \times \frac{2.21 \times 18.85^4}{1{,}6000{,}000 \times 0.00926} = 0.246 \text{ in.}$$

Ratio between secondary and primary eccentricities

$$= \frac{0.246}{0.440} = 0.558.$$

The total bending moment is the sum of a series which may be determined as follows:

$$M = \frac{M \text{ primary}}{1 - 0.558} = \frac{98.2}{0.442} = 223 \text{ in. lbs.}$$

$$f_c = \text{fiber stress in direct compression} = \frac{223}{0.2436} = 920 \text{ lbs.}$$

per sq. in.

f_b = fiber stress in bending (compression fibers)

$$= \frac{223 \times 0.358}{0.00926} = \frac{8625}{9545 \text{ lbs. per sq. in.}}$$

$$f \text{ allowable} = \frac{f_b}{f_b + f_c}(F - C) + C = \frac{8625}{9545}(10300 - 2200)$$

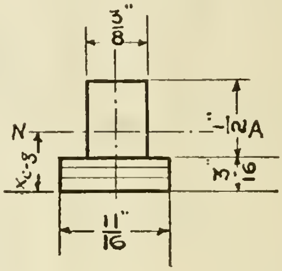
$$+ 2200 = 9525 \text{ lbs. per sq. in.}$$

Design of Chord Members

In the design of the chord members the face plies were considered fully effective and the core was ignored. The members were designed in the same manner as for the original ribs for direct stresses and bending moments. The effect of the eccentricity in the application of the direct stresses was ignored. The effect of column action at the panel points was allowed for by considering that each chord member was a column with a length equal to 25 per cent of the sum of the adjacent panels. The allowable stresses were reduced in accordance with the formula stated above for the design of web members. The stresses due to bending were computed about a horizontal axis through the center of gravity of the chord section. The theoretically correct method would be to determine the principal axes, moment of inertia about the principal axes, and finally the stresses at the extreme fibers. The analysis used, however, gave a uniform and adequate design. In the test the chords were restrained by guides from buckling sidewise. The fabric will exert the same restraining influence when the rib is assembled on a wing for flight.

The following test data was obtained during the test for low incidence. The distribution of the load along the chord for this type of loading is considered fully in the original report.

The test data was secured in the wood laboratory of the materials section. The test was conducted by Mr. R. L. Hankinson.



Test data on plywood truss ribs 180-in. chord with stiffeners on one side.

Rib No.	Total load	Deflection at center between beams	Weight in ounces	Failure
1	600	0.228	54.1	Buckling in lower chords; compression members in front of rear spar and in rear of front spar were strengthened by adding two pieces of 3-16-inch spruce.
1	600	.206	54.93	Column bending noted in compression members in front of rear spar and in rear of front spar. Various members strengthened (°).
1	750	.360	55.65	Test stopped on account of glue shear failure in front of rear wing beam.
1	1,200	.418	55.65	Failure in lower chord in second bay in rear of front wing beam by buckling and shear.
2	900	.285	56.05	Various members strengthened before test, Spar fastening failed, test stopped.
2	1,050	.304	56.05	Testing apparatus failed; no failure in rib.
2	1,250	.385	56.05	Compression member in front of the rear spar deflected in plane of the rib.

The strength-weight ratio of the first rib tested was 21.5 and of the second rib tested was 22.3 expressed in load supported divided by weight of final rib in ounces. This compares well with the strength-weight ratio of the original ribs, the difference being due to the additional material required in the web when designed for eccentric loads.

Conclusion

This type of construction is recommended strongly for its adaptability to production and strength. The only members which need be reinforced on both sides are the heavily stressed compression diagonals within and adjacent to the spars. The construction in which both sides of the web are reinforced is more stable laterally. To secure lateral stability when the construction in which reinforcing is used on only one side of the web is adapted, special care should be taken to secure lateral rigidity. This may be secured by section laths running along the top and bottom of the ribs parallel to the spars and attached to the ribs. These stringers should be fastened to the compression ribs in order to stabilize the series of ribs intervening. It is thought that taping alone will not be adequate to secure the necessary lateral rigidity.

[*Air Service Information Circular, Vol. III., No. 268.*]

COMPARATIVE EFFECT ON ENGINE OPERATION IN FLIGHT OF OUTSIDE AND INSIDE AIR INTAKES

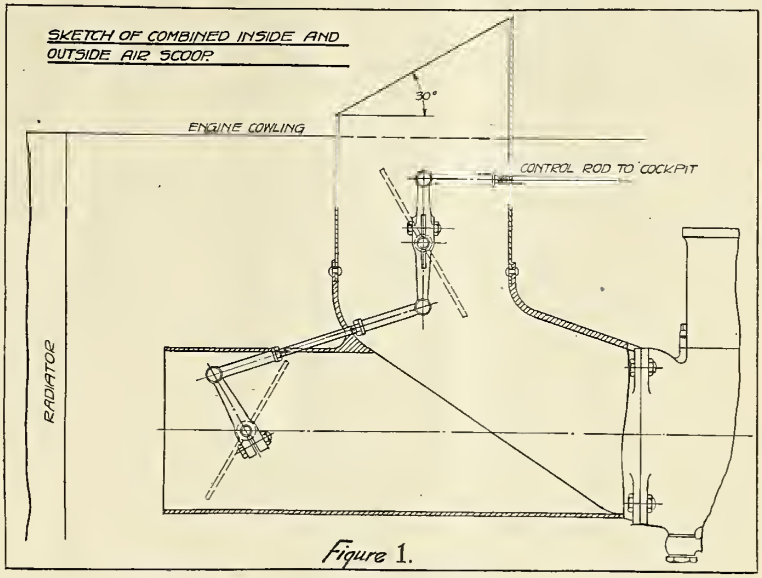


Figure 1.

Object of Test

This test was made to determine the effect on the engine operation in flight when taking the carburetor air from inside the engine cowling.

Summary and Conclusions

No difference in engine operation when using air from inside or outside the cowling can be observed. It is concluded, therefore, that either type of air intake as desired can be used. The outside air intake is much to be preferred on account of reduced fire risk.

Introduction

There has been considerable discussion among aeronautical engineers as to the relative merits of the outside and inside air intakes for airplane engines. The outside air intake, projecting through the engine cowling and cut off at an angle of 30° with the center line of the airplane, is standard practice with the Air Service (see Fig. 1). This type of intake is very important in reducing fire risk and insuring a supply of fresh air to the carburetors at all times.

It has been contended by some engineers, however, that engine operation would be greatly improved, especially at the higher altitudes, by taking warm air from inside the cowling, back of the radiator. It is claimed that this method also has the advantage of taking the carburetor air from an undisturbed location, rather than from a high velocity slipstream. This test was undertaken to determine whether or not the inside air intake possessed these possible advantages.

Description of Intakes

A vertical air scoop used with an NAD-6 carburetor on a Model "H" Hispano-Suiza engine was opened at the elbow and a short, straight piece of pipe fitted and brazed to the opening, arranged so that the vertical pipe took the air from the outside, while the straight extension took the air from the inside of the cowling. Large butterfly throttles were installed in each air scoop and, by means of a rod, operative from the pilot's cockpit. These throttles were interconnected, so that both air scoops could not be opened simultaneously. (See Fig. 1.)

Method of Test

A flight was made to about twenty thousand feet, at which altitude, in level flight, the air to the engine was drawn alternately from the two airscoops. The acceleration was also tried with each air supply by rapid opening and closing of the throttle. This was repeated at various lower altitudes, specifically sixteen, twelve, eight, and four thousand feet. The test was made in a two-seater experimental aeroplane, type XB-1A, and the ground temperature was approximately 89° F.

Results

No difference in engine operation, as indicated by engine revolutions per minute or acceleration, could be noted with either type of air intake. It is possible that warming the air to the carburetors may be of advantage in cold weather at low altitudes, but, due to the increased fire risk caused by the inside air intake, it is not recommended for this purpose. — *Air Science Information Circular.*

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1421 Chestnut Street
William H. Sheahan, ***1st Vice-Pres.***
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George S. Gassner, ***Sec. and Treas.***
1421 Chestnut Street

AERO CLUB PENNSYLVANIA

DIRECTORS

H. F. Bamberger
Charles L. Hower
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Frank A. L. Leahy
John W. Pratt
D. J. Spence, Jr.
A. Stanley Truscott

On December 22nd a most important meeting will be held in Philadelphia, by the Society of Automotive Engineers, to discuss the topic of aerial transportation. The Society of Automotive Engineers, whose membership of over 5,000 is composed of many of the foremost engineers, including a large number of the country's most prominent aircraft designers and builders, will hold a series of meetings at which various speakers will tell what has actually been done in this country and abroad in the way of commercial aviation.

The cost of aerial transportation per passenger mile and per ton mile will be given from figures obtained from flights that have actually been made on regular schedules. After recounting what has been done to date, the problems still to be solved will be discussed.

Among the important subjects that will receive attention are airways, landing fields, ground organization, legal aspects, radio and meteorological service and the relation of civil aviation to national defense. In connection with this last subject moving pictures will be shown of the recent bombing operation against the surrendered German battleships. These pictures have not previously been shown publicly.

Those who will take part in this program include J. G. Vincent, prominently identified with the Liberty motor; Glenn L. Martin, one of the pioneers of aviation; Ralph Upson, balloon expert, and Assistant Postmaster General Shaughnessy, who will give to the meeting important data regarding the air mail service.

With the idea in view of making Philadelphia one of the great airports of the country and to bring to the city its share of the aeroplane industry, the Chamber of Commerce has appointed a Committee on Aviation.

This committee is composed of the following members: Samuel B. Eckert, chairman, a major in the British flying forces during the war; Charles J. Biddle, who was a major with the American flying forces; Alfred M. Cohen, formerly a commander in the Navy; Stephen H. Noyes, an assistant bridge engineer for the city; Robert Glendinning, formerly of the American air forces in France; Joseph A. Steinmetz, president of the Aero Club of Pennsylvania and former president of the Engineers' Club, and Hollingshead N. Taylor, chairman of the Industrial Committee of the Chamber.

Uncle Sam has rendered a decision that children cannot be forwarded by aeroplane parcel post. Application was recently made by Mrs. Mary Pyle, of Washington, D. C. who wanted to send her three-year-old daughter Airlie to Philadelphia by air mail. Mrs. Pyle filed her application with the postmaster at Washington, requesting permission to ship her baby to Philadelphia in one of the Government mail carrying planes so she could spend the Christmas holidays with relatives in that city.

The request was refused on the ruling made some time ago under which the Postoffice Department stated children could not be sent from place to place as parcel post. The mother was also informed that the air mail service between Philadelphia and Washington was discontinued some time ago.

The stated monthly meeting of the Club was held the evening of November 25th, at the Club quarters in the Penn and Pencil clubhouse, 1026 Walnut Street. A large number of the members were in attendance to hear the report of the various committees and officers. During the month there had been special meetings when the matter of Philadelphia's future aeronautic activities and establishment of air fields and the development of air transports, were matters of interesting discussion.

The members present also discussed new names for nomination of officers and directors for the coming year and an earnest plea was made by Mr. Steinmetz, president of the Club, that the younger men and service groups be given consideration so that the Club shall derive inspiration, courage and new points of view from the men active in aerial development.

It was also decided to terminate the lease of the present quarters and file a formal application for affiliation with the Engineers' Club. It is felt by nearly all the members of the Aero Club that such an affiliation will give privileges which the Club does not at present have and will do much toward building up a large membership during the coming year. It is expected that the Club will soon be called upon to take an important part in the plans maturing for the Sesqui-Centennial of 1926, and will undoubtedly have charge of the aerial activities of the great celebration. The invitation of the Aero Club of Pennsylvania was extended to all the great aerial societies of France and England, and it is believed that thousands will arrive by the great airliners which by that time will be crossing the Atlantic over mapped and charted routes of the air.

The December meeting of the Club was held on the evening of the 16th, at the Engineers' Club of Philadelphia. A most interesting meeting was held and Mr. E. R. Armstrong, one of the pioneers of aviation, gave a talk on practical trans-Atlantic transportation, based on the study he has been making of the problem for years.

Mr. Armstrong has basic patents on practical anchorages for landing stations placed at "hops" of 500 miles apart in order to reduce the tremendous fuel load required by air-liners making non-stop flights. The entire idea has been worked out by Mr. Armstrong as an engineering problem and not a visionary scheme. Mr. Armstrong is well known in aeronautical work having contributed many writings to *Aero and Hydro,* one of the first aeronautical magazines published.

The following nominations of officers of the Club, for the coming year, were made. The election to take place at the annual meeting, January 20th: Joseph A. Steinmetz, president; William H. Shean, 1st vice president; H. F. Bamberger, 2nd vice president; George S. Gassner, secretary and treasurer; Chas. L. Hower, George S. Ireland, W. Wallace Kellett, Frank A. L. Leahy, R. G. Miller, D. J. Spence, Jr., and A. Stanley Truscott, directors.

W. H. Shehan,
1st Vice President.

REVIEW OF AMERICAN AVIATION FOR 1921

(*Concluded from page 387*)

ment and increasing importance of flight. The first American National Airway was opened by the Army Air Service between Bolling Field, Washington, D. C., and Dayton, Ohio. The Navy Department released four million dollars' worth of flying boat equipment for the civilian market at greatly reduced figures.

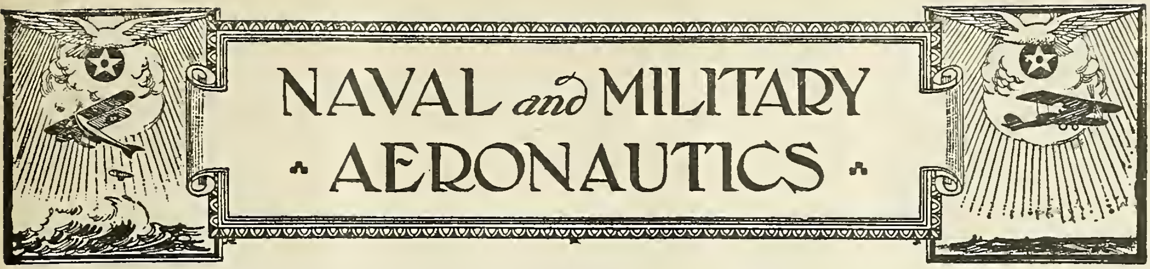
"Aviation units are being organized in the National Guard in many of the States of the Union. Many improvements were made in airplane design and in the internal combustion engine. Motors were made more reliable, more economical, as far as fuel consumption is concerned, and more efficient. New types of motors are being made, including the Wright, Lawrance, Packard, etc., radial, air-cooled, and steam, and what promises to be one of the most powerful in the world—an internal combustion engine of 700 horsepower under test at McCook Field, Dayton, Ohio.

"There were several distinct scientific advances. The aerial torpedo was produced, a secret invention and one of far reaching influence on aviation in peace and war. The 4,300 pound aerial bomb was also made and tested successfully, the Larsen all-metal armored monoplane carrying 30 machine guns, the torpedo carrying plane and the Navy scout. The geared propeller and multiple drive system was tested successfully by the Gallaudet Aircraft Corporation at East Greenwich, R. I. It permits the harnessing of three motors to one propeller. Perhaps a dozen different types of small sport machines were produced in this country in 1921. The Sperry 'Messenger' with Lawrance motor, the sport Farman, the Thomas-Morse racing monoplane, the Laird Swallow, the Longren folded wing sport plane, and others were introduced during the year.

"The U. S. Navy completed its giant dirigible hangar at Lakehurst, N. J. The Navy blimp C-7 was filled with non-inflammable helium gas and flown over Washington, D. C., to demonstrate its practicability. Lt. Ross Kirkpatrick made an American endurance flight record in a Curtiss plane of 18 hours and 6 minutes at Mitchel Field, L. I. The Foster Russell Aviation Co., of Spokane, Wash., made a 25,000 mile advertising flight among 225 towns in the Northwest. The Aeromarine 11-passenger flying cruiser 'Santa Maria' flew 9,000 miles on a Summer flight from Havana, Cuba, to New Orleans, via New York, Montreal, Toronto, Detroit, Chicago, St. Louis, and Memphis. The Navy launched a seaplane from its first catapult at League Island Navy Yard, Philadelphia, preparatory to equipping surface craft with fighting and scout planes. Fifteen flying boats of Aeromarine Airways alone flew 100,000 miles and carried 6,814 passengers, 29,002 pounds of freight and mail between Key West and Havana, and on the Atlantic Coast, Army, Navy and Marine Corps fliers made many important aerial surveys, such as those of the Olympic Peninsula in Oregon, the Mississippi River delta and the coastline of several islands in the West Indies.

"Forty-one army airplanes operated on the Aerial Forest Patrol in the National Forests on the Pacific Slope, made 396 patrols the last season, discovered 832 fires and daily provided protection to 7,230,459 square miles of valuable timber lands. The new Dayton-Wright forest patrol seaplanes were placed in operation in Canada during the Summer. Marine Corps planes used in revenue service located many stills on the Eastern Coast and on one occasion, last Sept. 2nd, located an entire moonshine village. The Bureau of Aeronautics was organized by the Navy Department, thereby co-ordinating the various divisions of Naval aviation. The First Air Brigade was organized by the Army Air Service at Langley Field, Va. Fliers patrol the entire Mexican border daily. The airplane rendered invaluable aid in flood, fire and pestilence, one of the most notable occasions being the Pueblo, Colo., flood last June.

"Approximately a score of flying meets were held in this country in 1921. Typical of these were the races, meets and demonstrations on Long Island, in Florida, Hartford, Conn., Baltimore, Chicago, Kokomo, Ind., Dallas, Denver, Oakland and Long Beach, Cal., several in Iowa and Nebraska and one of the most important, the American Legion Flying Meet at the National Convention in Kansas City, Mo., Oct. 31-Nov. 2nd."



NAVAL *and* MILITARY AERONAUTICS

Roma Christened

Washington.—The 400-foot army airship Roma fought her way for five hours and a half against a head wind from Langley Field to Washington Dec. 21 to be named and put in commission officially by Miss Fonrose Wainwright, daughter of the Assistant Secretary of War, who broke a bottle of liquid air on the prow of the dirigible.

Secretary Weeks, Secretary Denby and Senator Rolandi-Ricci, the Italian Ambassador, who participated in the ceremonies, waited for three hours in the chilling wind which blew from the northwest, for the ship to arrive. They were to have taken a flight in her over the city and to Baltimore with other invited guests, but the wind was rising steadily, and Major General Patrick, Chief of the Army Air Service, ordered the Roma back to her hangar at Langley Field as soon as she could be refueled.

The great dolphin-like craft arrived at Bolling Field at noon and departed at 2:30, scurrying home with the wind behind her, in two hours and forty minutes.

A crowd of guests and officers of the two air services awaited the arrival of the army's new semi-rigid, the largest lighter-than-air ship in this country, at Bolling Field from 9 o'clock, impatiently stamping their feet and trudging back and forth in an effort to keep warm. Aeroplanes left the field from time to time to search out the great ship, which was continually reported by radio as approaching from the southeast, but did not appear. Finally she was reported as over Alexandria, making slow progress against a stiff wind, with three of her motors frozen.

Suddenly in the southwest there appeared a great, dull-gray shape, scarcely distinguishable against the slate-colored sky. It was the Roma—a massive, fat dirigible, moving a little toward the east, slowly and majestically lifting her nose over the encircling hills. Gradually her bulk loomed up, and she swung toward the west, heading directly for the field, with her motors roaring deafeningly. Approaching quite low, she seemed barely to miss the trees and hangars as she pushed against the wind and finally, reaching the centre of the field, put her nose down and slowly settled.

A door in the V-shaped keel near the bow flew open and a great coil of rope dropped to the "handling" crew below. All hands took hold, and slowly the great craft came to earth.

The wind, sweeping from the north and west, swung the great ship back and forth as the men strained at the rope, while stay wires with cables attached were dropped out of ports along the keel to other men who stood by to steady her. Leveling off, but under the blast of her propellers, she settled on her "bumpers" and was landed, but she never stayed still a minute, swaying back and forth and carrying the men clinging to the ropes with her.

Then followed the naming by Miss Wainwright, who stood on a stepladder under the great curving bows as she broke the bottle of liquid air, which flew into a bluish-gray cloud of vapor as the glass crashed. The old ensign was then replaced by a new one presented by the Italians and hoisted high on the stern over her curious box-like rudder.

Speaking for Italy, where the ship was designed and built, Ambasador Rolandi-Ricci expressed his pleasure that America should have bought her, and Secretary Weeks, in accepting the airship for the War Department, said that the pleasure and opportunity were rather his, that the army should be so fortunate in securing a ship developed by the skill of Italian craftsmen.

Major J. G. Thornell and his staff of pilots and navigators were also thanked personally by Secretary Weeks for their successful trip, despite their handicap of an adverse wind and disabled motors.

After the naming the color presentation took place, Assistant Secretary Wainwright replying to Lieut. Gen. Giuseppe Vaccari, who spoke feelingly of the cordial relations between Italy and America as he presented the new American ensign for the Roma.

General Patrick then ordered the field cleared and the ship gassed and rebalanced for homeward flight. As the motors were tuned up the handling crew eased up on the hauling cable and the big ship rose slowly on an even keel.

As soon as she was clear of the field the "let go" signal was given and the cables were hauled up. She slowly forged ahead into the wind, turning to the southeast as she reached the edge of the field. At a height of a few hundred feet the engines were speeded up, and, assisted by the wind, she began her homeward trip at a high rate of speed, disappearing over the hills to the south.

Fire at Langley Field

Newport News.—Four large frame hangars at Langley Field were destroyed by fire Dec. 19. The property loss was more than $200,000. The origin of the fire is unknown and an investigation will be made by an army board of inquiry. One Martin bomber and most of the tools at the station were destroyed.

The buildings were among the first erected at the flying field several years ago. The fire originated in one of the centre buildings and spread so rapidly that all four were doomed in a few minutes. All but one or two machines housed in the hangars had been removed for practice purposes. This prevented a greater loss, as it was possible to remove only a very little equipment from any of the buildings.

Goodyear Making Navy Balloonettes

Akron, O.—Eighteen large balloonettes to be used as gas containers in the ZR-1, which will be the first rigid dirigible airship to be constructed in America, are being made for the Navy Department of the United States Government by the Goodyear Tire & Rubber Co.

The balloonettes will range in size from 200,000 cubic foot capacity down to 18,000 cubic feet. The government order calls for their delivery by July 1 to the navy hangar at Lakehurst, N. J. The hull of the ZR-1 is being made at Philadelphia.

In the manufacture of the huge gas containers, "Gold-beaters' skin" is being given its first extensive use in this country for the manufacture of balloon fabric. The material is the blind gut taken from the intestines of the steer. It was originally given the name of "Gold-beaters' skin" by reason of the fact that goldsmiths used the skins in making gold leaf by placing sheets of gold between the layers of skin and hammering into the filmy gold leaf.

Parts of the intestines of nearly one million steers will be used in the manufacture of the balloonettes. The use of the skins was first employed in Europe, never prior to this time having been extensively used in the United States. Goodyear is placing orders for the skins with all big packers in the country. They are being received in Akron packed in salt.

The membranes are soaked, cleansed and scraped and when dried each skin measures about 20 inches in length and eight inches in width. The skins are cemented together by a secret process and then are cemented over rubberized fabric and coated with shellac, forming a tough and slightly elastic lining for the gas containers.

The largest of the ZR-1 balloonettes being made by Goodyear is equivalent in gas capacity to that of the largest dirigible hull ever manufactured in this country. In other words, one of the ZR-1's eighteen balloonettes will be as large as most of the navy and army dirigibles of 200 foot length now in commission.

Goodyear is putting on a force of 300 girls and women to prepare the skins for the gas containers.

The C-7 Tests

Aeronautical experts agree that the three performances of the Airship C-7 with helium gas were excellent in every particular. The later part of the Hampton Roads Washington flight was made in a snow storm. Summed up, it can be said use of helium as a gas for the inflation of airships has been demonstrated beyond a doubt. Helium, with the exception of the fact that it is a slightly heavier gas, is superior in every other respect to hydrogen. In addition to the non-inflammable and absolutely inert character of helium and involves no fire risk whatsoever, the use of the gas is advantageous from the point of view of the operator as it does not expand and contract nearly as rapidly as hydrogen, a characteristic which makes for economical operation. The diffusion of helium is much less than hydrogen and especially through rubberized fabrics. During the three flights of the Airship C-7, no helium whatsoever was lost in operation by valving.

FOREIGN NEWS

The Ad Astral Silencer

There can be no doubt that the noise which accompanies flying in an aeroplane is a serious source of discomfort to passengers, and that any practicable method of reducing the noise deserves the attention of all designers of passenger-carrying aircraft. Although engine exhaust is by no means the sole cause of such noise it is nevertheless an appreciable part of it, particularly of such noise as is appreciable within the cabin of a modern passenger-carrying machine.

The Swiss Ad Astra Company, whose business is very largely of a joy-riding nature, have taken up this subject in earnest, and have developed and perfected a type of silencer designed by M. Birger, and now known as the Ad Astral Silencer.

This silencer is to some extent based on the same principles as the usual automobile silencer, in that it comprises an expansion chamber and a series of baffles, but it depends to an even greater extent on the thorough cooling of the exhaust gases, before they are allowed to escape. Obviously such cooling greatly reduces the volume of the said gases, and therefore the velocity of their escape, with consequent reduction in the noise.

The Ad Astral Silencer consists of a steel chamber of ovoid or streamline form, whose interior is divided up into three sections by nearly vertical partitions. The engine exhaust enters the central partition at the tail of this body, passes through to one of the side sections at the fore-end, passes across to the other side at the tail again, and emerges through a number of holes at the front of the body. But the gases do not yet escape into the open. Over the nose of the body is fitted an aluminium spinner, with deep spiral corrugations. This spinner is mounted in ball bearings, and is caused to spin by the action of the slipstream on the spiral corrugations. It is claimed that this rotary motion of the spinner causes marked turbulence in the gases within, a condition known to facilitate transfer of heat from the gas to the walls of the containing vessel.

A demonstration of this silencer fitted to a Siddeley "Puma" engine in a D.H.9 belonging to the British De Havilland Aircraft Company was arranged for Nov. 29th. Fog prevented flying on this occasion, but when running the engine on the ground, the silencer undoubtedly suppressed the exhaust noise of the engine, and very distinctly reduced the total volume of sound. It should be noted that at rest on the ground the noise directly due to the airscrew is considerably greater than when the machine is in flight.

Cutting in or out of the silencer with the engine running at full throttle did not produce the slightest flicker of the rev.-counter, and after a total of some ten minutes' run the silencer, and particularly the rotating nosepiece thereof, were remarkably cool.

Tests of the silencer made by the Swiss Federal Air Service Authorities indicate that the silencer does not reduce the power developed by the engine to which it is attached, and that if anything the engine runs cooler with than without the silencer.

The Royal Aircraft Establishment at Farnborough have tested the apparatus and have reported favorably as to its silencing properties.

The silencer appears to be somewhat bulky—the specimen used on the "Puma" is about 1 ft. diameter by 4 ft. long over all—and weight about 45 lbs., but one gathers that it was designed for an engine of some 360 h.p. Owing to its excellent shape the resistance is probably small, and there seems little doubt as to the excellence of its silencing properties.

The British rights in the Ad Astral Silencer are at present in the hands of Sir W. Maxwell, K.B.E., of 6, Broad Street Place, E.C.2.

Australian Air Mail

As the result of Government encouragement the first regular aerial mail service contract was accepted by Major Brearley, D.S.O., for a weekly service between Perth, Geraldton, and Derby, W. Australia. The service, which is booked to start every Monday from Perth, is intended to reach Geraldton before noon the same day, and Derby, which is 1,500 miles from Perth, shortly after noon on the Wednesday, returning to Perth on the Saturday afternoon.

The Defence Department has granted a subsidy of £25,000 for the service, which works out at the rate of 4d. per air mile. The machine to be used is a Bristol "Tourer" (240-h.p. Siddeley "Puma").

Unfortunately the first flight on Dec. 5th was marred by a fatal accident, at about 100 miles from Geraldton, when the machine piloted by Lieut. Fawcett, fell from a height of 50 feet and the pilot and mechanic-passenger were killed.

The Forthcoming Air Conference

The British Ministry announces that the first Air Conference proved so useful in focussing attention on the many and intricate problems of aviation and in bringing about a frank exchange of views on the subject, that the Air Council has decided to call together another Conference. This second air parliament will be held by permission of the Lord Mayor and Corporation at the Guildhall on February 7 and 8, 1922.

The conference, which will be opened by the Lord Mayor, will, on this occasion, be asked to address itself mainly to the question of the future of aviation, with special reference to its development as a regular and speedy form of commercial transport.

As a matter of convenience the papers will be divided into two main groups, the one dealing with civil aviation in general and the other with technical problems, the papers on the former subject being delivered at the morning session of the first day, and the papers on the latter during the afternoon session of the same day. The proceedings on the second day will be devoted wholly to discussions arising out of the previous day's papers, the morning session being allotted to civil aviation and the afternoon to discussions on the technical papers.

There will be two Chairmen: the Secretary of State for Air, who will preside during the civil aviation portion of the proceedings, and Lord Weir of Eastwood during the technical sessions.

The principal paper on civil aviation will be read by Lord Gorell, Under-Secretary of State for Air, who will give a general account of progress at home and abroad, and will direct attention to a consideration of the ways and means whereby the development of civil aviation at home and in the Empire may be best furthered. In this connection Lord Gorell will endeavor to enlist the practical co-operation of business and other interests.

The main technical paper will be read by Mr. F. M. Green, of Sir W. G. Armstrong, Whitworth Aircraft Limited; the names of the other speakers will be communicated later.

In order that the Conference may be fully representative of all sections of the community who are now interested in the development of aeronautics, or who are considered to have a potential and growing interest in air transport development, special invitations are being issued to all coming within these categories, particular efforts being made to secure so far as possible the attendance of representatives of large business groups and organizations.

Arrangements are being made which will permit of members of the Conference who desire to do so visiting the London terminal aerodrome at Croydon on Monday, February 6. The operations of the various Continental air transport companies will then be seen and explained; in addition, as many types of civil aircraft as possible will be concentrated at Croydon to afford members an opportunity of seeing for themselves the range which is being covered by commercial designs. Demonstrations of amphibian aircraft alighting on the Thames will also take place during the period of the Conference.

Aviation Finding a Home in Australia

The Australian Federal Government is carrying out its determination to utilize aircraft for long-distance postal and for limited passenger service, and the latest information upon this development comes from *The London Times'* Melbourne correspondent. Tenders have been accepted for such services between Adelaide and Sydney, and again between Sydney and Brisbane, 750 and 575 miles respectively as the crow flies. By rail the distance from Adelaide to Brisbane is 1,800 miles, and occupies four days. The subsidy for the first section is £17,500 a year, and for the second £11,500.

Tenders are also being called for a service between Charlesville and Cloncurry, in Queensland, a distance of 575 miles, much of it over country which in the rainy season is proctically impassable.

Recently an aviator arrived in the centre of Australia in comparatively few hours, covering a distance which occupies carters' wagons two months. Added to the service in West Australia, there will soon be 3,000 miles of postal and commercial aerial highways in constant operation. If the experiments are satisfactory, they will be extended and will solve one of the great communication problems of Australia.

On the other hand, the Federal Parliament has seen fit to reduce the Defence estimates by £100,000, which means the practical abondonment by the Government of the air scheme outlined earlier in the year. The two squadrons of flying boats have both been abandoned, and the two seaplane squadrons, one active and one reserve, modified to six machines, three active and three reserve. The scheme now amounts to the carrying on with what is possessed at the present time, with the addition of several Avros ordered at a local factory.

Irish Free State and Aviation

It is to be noted that in the peace terms with the new Irish Free State provision is made by the British Government for "Facilities in the neighborhood of the above Ports (Berehaven, Queenstown, Belfast Lough, and Lough Swilly) for Coastal Defense by Air," and further, that "A Convention shall be made between the same Governments for the regulation of Civil Communication by Air."

Congo Air Mail

The air mail service on the Upper Congo is now available. The rapid transmission of correspondence from Great Britain by the aeroplane service which has linked up with the European steamship arrangements is now operating between Kinshaba and Stanleyville. The air service is scheduled to take three days, as compared with fourteen days by river boats. An air letter fee of three francs per twenty grammes is chargeable to the addressee on delivery.

New Aluminum Alloy Developed

A new aluminum alloy, lighter than pure aluminum and said to have mechanical properties which make it superior to the ordinary aluminum-zink-copper alloy, has been developed in Germany and is being commercialized under the name silumin. It is an alloy of aluminum with 14 per cent silicon, its specific gravity (2.5 to 2.65) being about 10 per cent less than that of the most common aluminum alloys and also slightly less than that of the pure metal. The tensile strength of 28,400 ℔ per square inch is from 25 to 30 per cent greater than that of the alloys mentioned, and the elongation of 5 to 10 per cent is, on the average, more than twice as great. At high temperatures silumin is also superior to the ordinary alloys in this respect. With increasing temperature the tensile strength decreases at first slowly and then gradually more rapidly. The hardness at room temperature is 85,000 ℔ per square inch (under a load of 500 kg. and a 10-mm. ball); at 350 deg., 28,000 to 35,000 ℔ per square inch. Wet steam has hardly any effect on silumin, the same as on pure aluminum. Dilute hydrochloric acid (25 per cent), as well as concentrated acid, attack it less than pure aluminum. The new alloy is said to be a better conductor of heat than any other similar alloy, its conductivity being to that of pure aluminum as 4.7 is to 4. The coefficient of heat expansion is 0.88 in that of pure aluminum.

The alloy is produced by combining aluminum and silicon, but it can also be produced electrolitically. After it has been poured it is subjected to a heat treatment.—From Zeitschrift des Vereines Deutscher Ingenoieure.

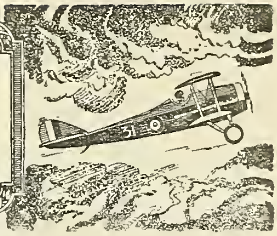
Italian Constest in 1922

The Minister of War has approved the proposal of the High Command for Aeronautics to hold two flying contests during September, 1922, the Tyrrhenian Cup and the Italian Grand Prix.

There will also be a parachute competition with prizes of 500,000 lire and a balloon contest with prizes of 30,000 lire. All the above events are international.

In order to encourage those aircraft constructors whose machines do well in the contests, the Ministry of War has set aside 400,000 lire for the acquisition of these machines, which will then be handed to the civil aviation companies by way of subsidy, for the operation of civil air services.

ELEMENTARY AERONAUTICS and MODEL NOTES



CLUBS

PACIFIC MODEL AERO CLUB
240 11th Avenue, San Francisco, Cal.
Portland Chapter: c/o J. Clark,
Hotel Nortonia, Portland, Ore.

PACIFIC N. W. MODEL AERO CLUB
921 Ravenna Blvd., Seattle, Wash.

INDIANA UNIV. AERO SCIENCE CLUB
Bloomington, Indiana

BROADWAY MODEL AERO CLUB
931 North Broadway, Baltimore, Md.

PASADENA ELEM. AERONAUTICS CLUB
Pasadena High School, Pasadena, Cal.

NEBRASKA MODEL AERO CLUB
Lincoln, Nebraska

BUFFALO AERO SCIENCE CLUB
c/o C. Weyand, 48 Dodge St., Buffalo, N. Y.

ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.

SCOUT MODEL AERO CLUB
304 Chamber of Commerce Bldg.,
Indianapolis, Indiana

MILWAUKEE MODEL AERO CLUB
455 Murray Ave., Milwaukee, Wis.

THE JUNIOR CLUB OF AERONAUTICS,
KANSAS CITY, MO.

CAPITOL MODEL AERO CLUB
1726 M St., N. W., Washington, D. C.

AERO CLUB OF LANE TECH. H. S.
Sedgwick & Division Sts., Chicago, Ill.

LITTLE ROCK MODEL AERO CLUB
1813 W. 7th St., Little Rock, Ark.

Successful Banquet of the I. M. A. C.

The tenth annual banquet of the Illinois Model Aero Club, held at the Auditorium Hotel, Chicago, on November 18th, was a complete success and larger than ever before.

A very attractive little menu and program booklet list the features of the evening's entertainment as follows:

Address, by president (Mr. Louis Chatroop); Toastmaster, Mr. J. J. Lucas; "The Past of the I. M. A. C.," Mr. D. W. Pease; Musical Selections, Mr. Jameson and Company; Readings, Mr. Richard Swander; "Today and Tomorrow with the I. M. A. C.," Mr. Warren H. De Lancey; "Mail Transportation in Nineteen-Fifty," by club members; "Why Fly Models?" Mr. James S. Stephens; Piano Solo, Mr. Raymond Oberndorf; "Boys' Sport," J. Lewis Coath; "Aircraft," Mr. Charles Dickenson; "The Dream of a Model Aviator," Mr. Topf; Song Leader, Master E. Lange.

Major R. W. Schroeder was to have given an address, but was prevented from attending because of illness in his family, but he announced later that he would offer a cross-country flight as a prize in the I. M. A. C. spring contests.

The banquet committee was composed of Joseph J. Lucas, chairman; Edward Topf, Walter Brock and W. H. De Lancey. The I. M. A. C. officers from July, 1921, to January, 1922, are as follows: President, Louis Chatroop; 1st Vice-President, Harry D. Wells; 2nd Vice-President, Walter Brock; Secretary, Robert Jaros; Treasurer, Lynn Davies; Contest Committee Chairman, W. H. De Lancey.

Air Scouts Organizing at Newport News, Va.

Under the leadership of Dashiell Wright, Boy Scouts of Newport News, Va., met at St. Paul's Parish House, December 9th, and started the ball rolling toward the organization in this country of Aerial Scouts.

Major Samuel Stewart, elected executive pro tem, is taking up with New York scout executives the matter of organizing the new class of scouts. The scouts in meeting asked him to do so.

Troop Number One, Boy Scouts, will ask for a new charter as Troop Number One, Aerial Scouts, and Troop Number Eight, Boy Scouts, will ask a new charter as Troop Number Two, Aerial Scouts.

"A lot of the fellows are interested," said Wright. "We will start off with a big group. Then we expect groups to be organized in other cities and towns until our organization is as well known as that of the Sea Scouts and Boy Scouts."

The Air Scouts will become proficient in construction work on aeroplanes, or in other words, will be trained in aviation ground work and mechanics.

The young man has had this scheme in his mind for a long time. He has talked with many of the officers at Langley Field about it and they have given him encouragement, among them Licensed Pilots Mays, Wood and Powell.

Major Stewart, of Fort Monroe, has advised the young man to start such a movement, and has assured him of the major's support. He has won praise for his plan locally also.

Young Wright has invented several mechanical devices and among them a folding box kite. He has made several areoplanes modeled after planes now in use. They all fly. They have been exhibited in army camps and in scout meetings in Newport News.

In speaking of young Wright, R. E. Gourlie, scout executive, said:

"Dashiell Wright is one of our best scouts. He has a number of merit badges, among them one for aviation. He has built a number of aeroplane models and has demonstrated several flights before the Court of Honor. He has an inventive mind and I take pleasure in endorsing him. He is a good scout."

All Model Clubs, scouts, scoutmasters and others interested are requested to get in touch with Major S. T. Stewart, Fortress Monroe, or Dashiell Wright, Patrol Leader, Troop No. 1, Boy Scouts, 129 31st St., Newport News, Virginia.

A Scale Model of the Thomas-Morse Scout

A carefully planned scale model of a Thomas-Morse S4-C Secondary Training Scout plane has been constructed by Walter W. Fitch, 140 Howell Street, Canandaigua, N. Y. Although he is but fifteen years old, the fine workmanship and regard for good proportions shown in this model is an evidence of his skill and interest in aeronautics.

The general dimensions are:

Span (upper wing)	20 inches
Span (lower wing)	19 inches
Chord (upper wing)	4¼ inches
Chord (lower wing)	3¾ inches
Gap between wings	3½ inches
Stagger	1 inch

The wings are cut of solid pieces of Cypress covered with cloth, varnished and painted the khaki color used by the Army Air Service.

Control horns on the elevators are of veneer.

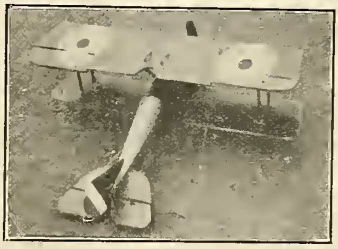
The body is also cloth-covered, to give the appearance of reality. It is built up of white wood. An aluminum seat is placed in the cockpit; a control stick is located in front of it, but difficulty was encountered in making it operate properly. A windshield is placed ahead of the cockpit.

Aileron control pylons are made of copper wire.

A piece of metal projects down for the tail-skid just as on the full-sized plane.

The propeller is carved from a piece of redwood.

Mr. Fitch is anxious to get into communication with other "aviation fans" whose interests are along similar lines of endeavor.



A 20-inch scale model of the Thomas-Morse S4-C Scout Aeroplane

A-E-R-O-N-I-T-I-S

To the Aviator

Far, far aloft majestically thou glidest.
A valiant wanderer through azure depths of space.
Some craggy, sunny Ithaca perchance thou seekest,
Where 'mong the clouds they're watching for thy dauntless face.

O'er what vast reaches hast thou ploughed thy way?
What cities seen enskied? What haunts of men diverse?
Defying hoary gods, not heeding what they say,
Though buffeted by tempest, tossed by winds adverse?

Have joyous dolphins played about thy churning prow?
Hast thou been lured by smiling sirens of the sky?
Canst thou escape the wiles of cunning Circe now,
And free thy mates who wallow in her stinking sty?

As one who's left for aye thy landings here below,
Thou sail'st o'er us who live on earthly levels bare;
Kin thou to those intrepid voyagers of long ago,
As vanquished they the sea thou makest conquest of the air.

He who in beginning gave to man in love
O'er all the teeming earth and fruitful sea so vast
Dominion, o'er these silent realms above,
To him now gladly gives supreme control at last.

Night falls apace and hides thee from our wondering gaze,
But we'll not grope and stumble on as those bereft
While threading the winding paths of this our earthly maze,
For we with courage new and larger faith are left.

Kelly Field, Texas. EDWARD DAY.

Poor Mary

Oh Mary had an airplane,
With shining wing and rod
And she said that she would drive it—
She wouldn't be a clod.

She pushed herself into it,
Completely dressed and shod
And somewhere in the cockpit
She gave the thing a prod.

She pushed a little lever and
With a little nod
She left our terra firma
For upper ways introd.

She pushed another lever
When she found it acting odd
And now she's pushing daisies
From the cemetery sod.

My Bonnie

My Bonnie went down to the cellar,
A leaking gas pipe he would see,
He lighted a match for to find it,
Oh bring back my Bonnie to me!

My Bonnie goes down to the cellar,
Quite often, alack and alas!
He comes back a different feller,
But he doesn't get lit up on gas!

Father was standing before the fire and lecturing to his son and heir on the necessity for thinking twice before speaking.

"Father" exclaimed the boy.

"Think twice, my son," admonished Father.

The boy pondered for two minutes, and then said: "Father, I have thought twice and I am quite convinced that your coat tails are on fire."

Tramp: Please, Mr., give me a dime for some bread?

Gentleman: Can't you go into any business that is more profitable than this?

Tramp: I'd like to open a bank if I could only get the tools.

Minister—Now, Uncle Ephraim, do you think you're doing right to leave your wife at the washtub while you go off fishing?

Ephraim—Suttingly, sah; mah wife kin be trusted, she kin; she wuks jes ez hahd when I'm away ez when Ize a watchin' of her, she do.

C. P. O. at morning quarters—"Put your hat on square on your head. You don't see me going around with my hat on the the back of my head, do you?"

Boot—"No, but you've got an anchor to hold yours down." —*California Cub.*

Making Good

She said
She would
Go through anything
With me,
So she started
On my
Bank account.
—*Pitt Panther.*

Hints for Dancers

1. If punch is served, don't allow the ladies to crowd you away from the bowl.
2. In making an approach on the bowl, knock everybody down who gets in your way.
3. If by mistake a lady happens to get within reaching distance of those serving, try to spill a glass or two on her gown so she'll have better manners next time.
4. Move alongside the bowl and mop up about eight or ten glassfuls as soon as you can.
5. If the floor is crowded make all the speed you can while dancing. Thirty-five knots is the latest standard speed.
6. Do all the fancy steps you know. If you think of some you want to try now is your chance. It is bad form not to walk on other people's feet while doing this.
7. If some bird wants to introduce you to his girl make him bring her over to where you are standing.
8. After you have engaged a dance with her, tell her where she can find you when the dance starts.
9. When the orchestra plays a tune you know, either whistle or sing the chorus. Your partner has never heard it before.
10. Don't forget to take a couple of packages of chewing gum with you to the dance. When you have finished chewing your gum drop it in the middle of the deck. This tends to improve the floor and those dancing will appreciate your efforts.—*Sub Base Ballast.*

An aviation machinist mate took his girl to dinner the other evening and when he said "Will you have a little shrimp?" she replied, "Oh, this is so sudden!"

Automobiles we like to ride in,
But to stroll on foot is better,
If a maid is strolling with us,
And we truly hope to get her;
But in nineteen twenty-one wooing
BUICK'S seem to be in style,
On the cushions billing, loving,
You'll find Loupos all the while.

"Yes, ma'am," said Mary, "I'm going to leave you. I don't like that snip of a dude that calls on Miss Mabel."

"The idea!" exclaimed the Norfolk lady; "he doesn't call to see you, so what"—. I know he don't, ma'am; but I'm afraid one o' the neighbors might think he does."

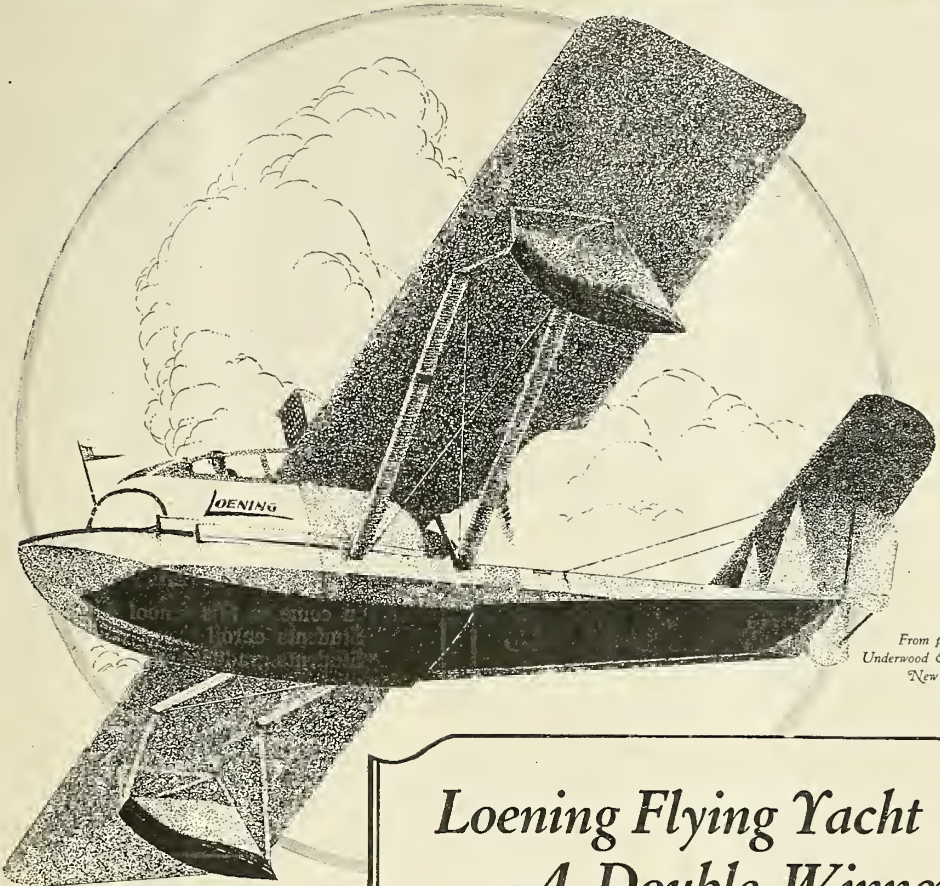
Captain: "Young man, I've had my eye on you for some time and—"

Private: "I'm quittin' y' can't fire me."

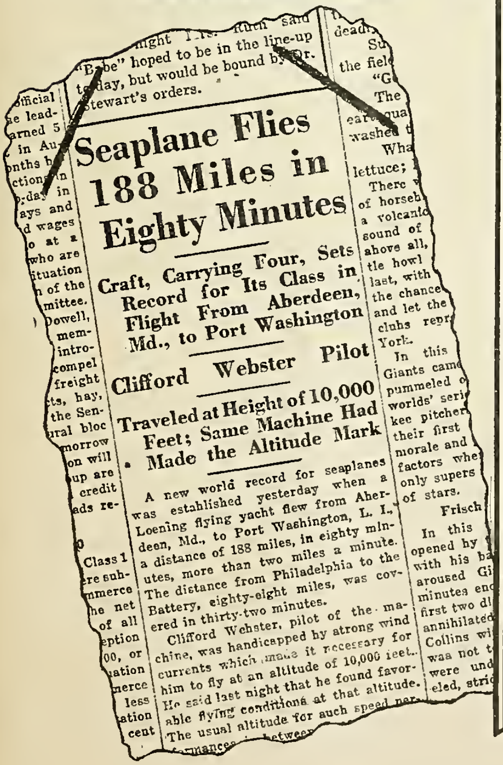
Mr. Blue: How would you like to have me for your second husband?

Mrs. Gray: Go on with you! Wait 'till I'm a widow before you ask me.

Mr. Blue: Well, you are one. Gray was just run over by an automobile.



From photo by
Underwood & Underwood,
New York.



"Babe" hoped to be in the line-up today, but would be bound by Dr. Stewart's orders.

Seaplane Flies 188 Miles in Eighty Minutes

Craft, Carrying Four, Sets Record for Its Class in Flight From Aberdeen, Md., to Port Washington

Clifford Webster Pilot

Traveled at Height of 10,000 Feet; Same Machine Had Made the Altitude Mark

A new world record for seaplanes was established yesterday when a Loening flying yacht flew from Aberdeen, Md., to Port Washington, L. I., a distance of 188 miles, in eighty minutes, more than two miles a minute. The distance from Philadelphia to the Battery, eighty-eight miles, was covered in thirty-two minutes.

Clifford Webster, pilot of the machine, was handicapped by strong wind currents which made it necessary for him to fly at an altitude of 10,000 feet. He said last night that he found favorable flying conditions at that altitude. The usual altitude for such speed performances is between

Loening Flying Yacht —A Double Winner

The clipping reproduced from the New York Tribune tells of the latest achievement of the *Loening Flying Yacht.*

This sturdy plane is a double winner. For, three weeks before making this speed record, she established a new altitude record for her class. Carrying pilot and three passengers, she nosed her way skyward until the sealed barograph registered 19,500 feet.

Long months of painstaking experiment in design—careful testing of materials to be used in construction—preceded these achievements. Every effort was expended to obtain the finest equipment. And it is a significant fact that the *Loening Flying Yacht* is

Valsparred, of Course!

VALENTINE'S
VALSPAR
The Varnish That Won't Turn White

VALENTINE & COMPANY
Largest Manufacturers of High-Grade Varnishes in the World—Estab. 1832
New York Chicago Boston Toronto London Paris Amsterdam
W. P. FULLER & Co., Pacific Coast

HARTSHORN STREAMLINE WIRES

Assembled with Hartshorn Universal Strap Ends make the Ideal Aeroplane Tie Rods—diminished wind resistance insuring greater speed.

This fact was proved in the speed test for the Pulitzer Trophy. Four of the first five ships were equipped with Hartshorn Streamline Tie Rods.

Write for circular A-1 describing our Wires and Strap End Fittings.

STEWART HARTSHORN CO.
250 FIFTH AVENUE, NEW YORK

MOTOR REBUILDING
CYLINDER GRINDING
ALUMINITE PISTONS
Iron Pistons, Piston Pins and Rings.

COMPLETE MOTORS
Parts for all airplanes and motors.
Finest equipment in U. S. for motor work.

GREEN ENGINEERING COMPANY
Dayton, Ohio
Main St., at Burns

New Aeroplane Supply Sale

Acetate Dope Guaranteed 55 Gal. Drum and 50 Gal. Bbls. $1.00 per Gal. No charge for containers. 5 Gal. lots $2.25 per Gal.

Spar Varnish, 5 Gal. cans, $2.25 per Gal.

Green Brown Wing Enamel, 5 Gal. cans, $1.50 per Gal.

TYCOS ALTIMETERS, register 20,000 feet radius, $15.00 each.

New Leather Aviation Helmets, $5.00 each, cost $18.00.

½" Brass Gasoline Stop Valves, $6.00 per Doz.

AC Spark Plugs Metrics $3.00 per Doz. $20.00 per hundred. $180.00 per M.

4" Barrel Turnbuckles $3.00 per Doz. $15.00 per hundred.

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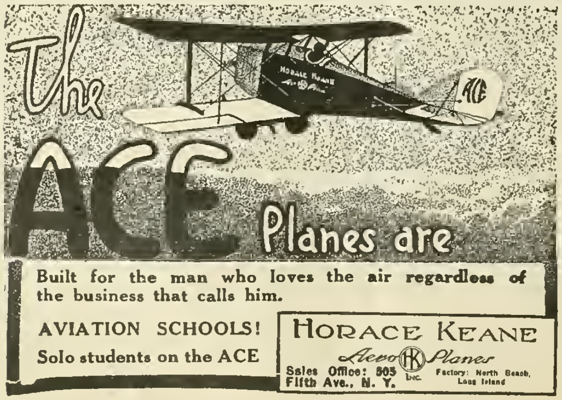

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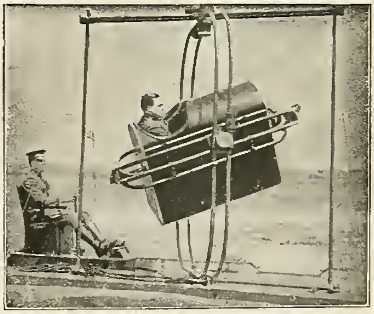

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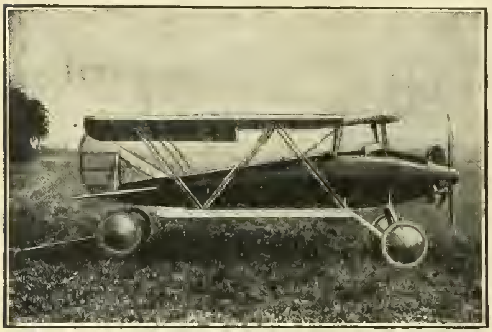

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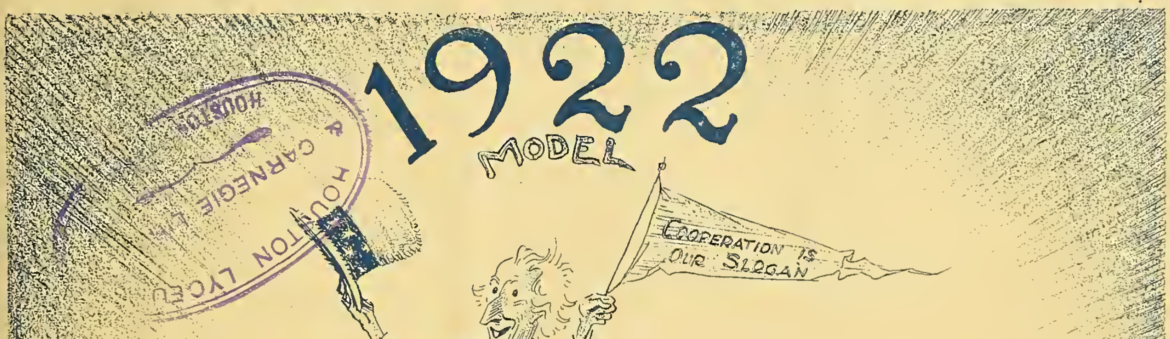
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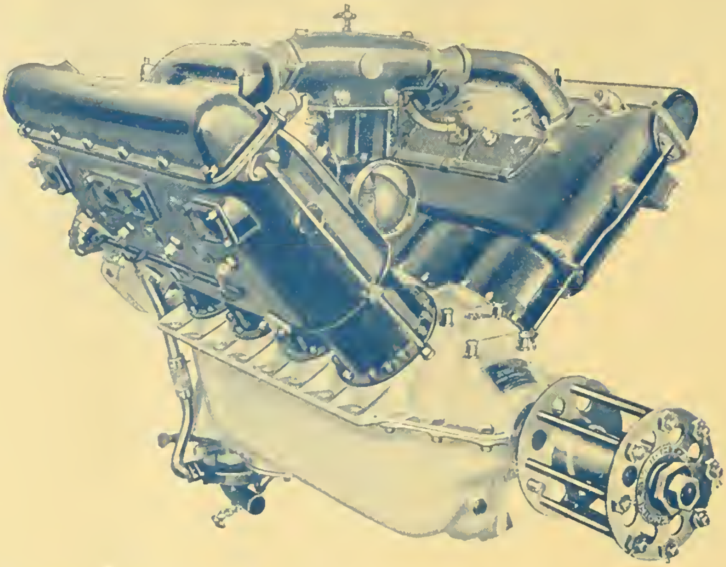

The Vital Requirements of Pursuit Engines

THE non-production of pursuit aviation engines in this country during the war was largely due to the lack of experience in this field.

Just prior to the armistice, however, the three-year development work of this Company on pursuit types culminated in the development for production of the 300 horse power Wright Engine.

When this Company determined that the manufacture of aeronautical engines was to be its sole aim, it determined also to concentrate first upon a pursuit type which would have no superior and, if possible, no equal, principally because its experience had proven that the pursuit type is the first line of aerial defense. With the entire personnel of this Company working toward this end the development of

THE WRIGHT PURSUIT ENGINE
The Standard Pursuit Engine of the U. S.

has been accomplished and meets, beyond all question, the vital requirements of the pursuit type; first, minimum weight per horse power, second, compactness, third, reliability, fourth, interchangeability.

The fullest measure of this development is expressed in the Wright Model H—3 Engine, official tests of which are a matter of record.

"The Identification of Incomparable Service"

WRIGHT AERONAUTICAL CORPORATION, *Paterson, N. J., U. S. A.*

WRIGHT

PURSUIT ENGINES

THE STANDARD PURSUIT ENGINE OF THE UNITED STATES

January 9, 1922

AERIAL AGE
WEEKLY

VOL. XIV, No. 18

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This Pilot soys:
"I have flown the Lincoln Standard over four States and consider it the best ship on the market. Its ability in tight places is wonderful."

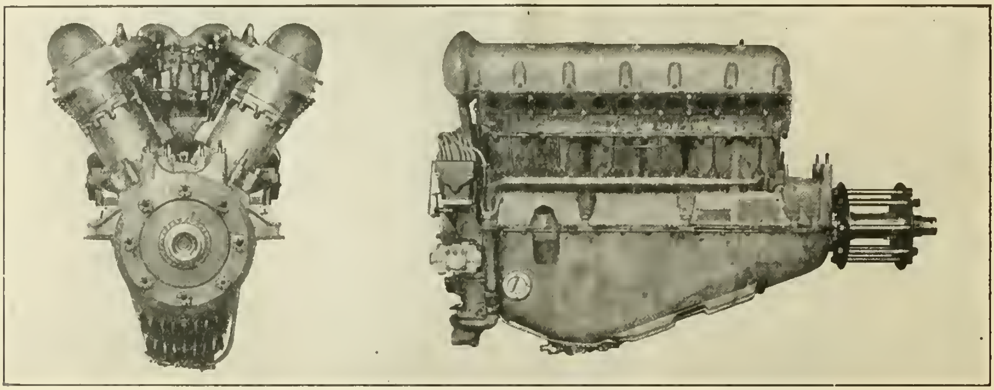
Price $3985
F. O. B. Factory

Ted LeCocq, Pilot (at left)
D. Swanson, Mechanic
Flying Lincoln Standard Speedster

"Man-O-War"
Owned by Mr. Collins of
Collins Oil Co., Knoxville, Ia.

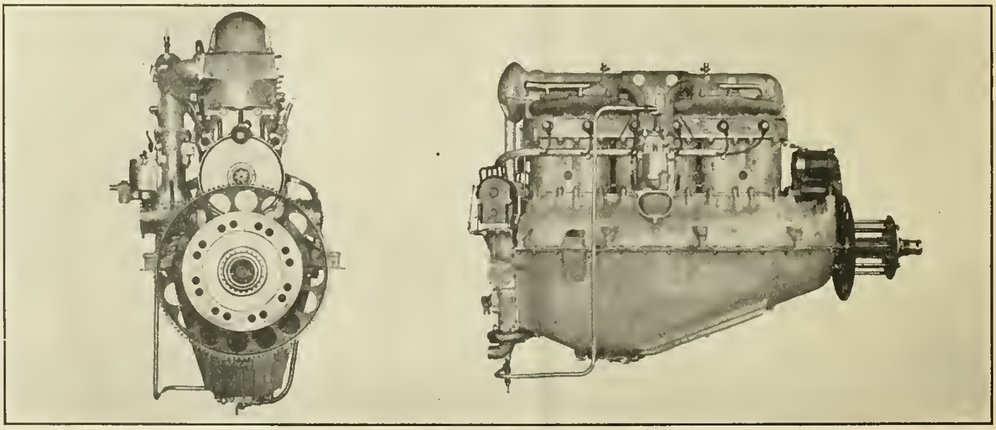
NEBRASKA AIRCRAFT CORP.
Lincoln, Nebraska

Curtiss



"CURTISS" MODEL CD-12 AVIATION ENGINE

Number of cylinders	12	Weight dry but complete	700 lbs.
Arrangement and angle of cylinders	60° vee	Weight of jacket water	38 lbs.
Water or air cooling	Water	Piston displacement	1145 cu. in.
Bore	4½ in.	Brake M.E.P. per sq. in.	135 lbs.
Stroke	6 in.	Compression ratio	5.7:1
Brake Horse Power	385	INSTALLATION DIMENSIONS:	
RPM of crankshaft above BHP	2000	Overall length	58⅛ in.
Reduction gear ratio	Direct Drive	Overall height	37½ in.
Gasoline per hour	32.1 gals.	Overall width	28¼ in.
Gasoline per BHP hour	.50 lbs.	Height above engine bed	21½ in.
Oil per BHP hour	.015 lbs.	Thickness of engine bed	1½ in.



"CURTISS" MODEL C-6-A AVIATION ENGINE

Number of cylinders	6	Weight dry but complete	420 lbs.
Arrangement and angle of cylinders	Vertical	Weight of jacket water	19 lbs.
Water or air cooling	Water	Piston displacement	572.5 cu. in.
Bore	4½ in.	Brake M.E.P. per sq. in.	128 lbs.
Stroke	6 in.	Compression ratio	5.2:1
Brake Horse Power	160	INSTALLATION DIMENSIONS:	
RPM of crankshaft above BHP	1750	Overall length	57 19/32 in.
Reduction gear ratio	Direct Drive	Overall height	40¾ in.
Gasoline per hour	13 1/3 gals.	Overall width	23 3/32 in.
Gasoline per BHP hour	.50 lbs.	Height above engine bed	24 11/32 in.
Oil per BHP hour	.015 lbs.	Thickness of engine bed	1½ in.

CURTISS AEROPLANE & MOTOR CORPORATION

Garden City, Long Island, New York

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AERIAL AGE
WEEKLY

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THE NATIONAL
TECHNICAL, ENGINEERING AND TRADE
AUTHORITY

With which is consolidated
Flying

Published weekly by THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

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VOL. XIV NEW YORK, JANUARY 9, 1922 No. 18

THE PRESS ON THE LARSEN ACHIEVEMENT

THE remarkable continuous flight of twenty-six hours, nineteen minutes and thirty-five seconds made by pilots Stinson and Bertaud in the JL-6 all-metal monoplane under very bad weather conditions did more than to transfer to America another hard won world's record in aviation. It brings forcibly to the public mind the marvelous development of aerial transport, its security and its possibilities of performance.

The machine was specially designed for commercial transport after the war. It is equipped with a limousine cabin designed to carry six passengers in comfort. Throughout the twenty-six hours it circled around the bleak plains of Long Island, at times against a terrific gale, the machine covered approximately a distance of 2,600 miles. With the wind behind it it would have flown from this city to Berlin and under normal conditions would have made London easily. When it alighted there was still sufficient fuel to have kept the machine in the air another seven hours. During the continuous flight of twenty-six hours two extra passengers could have been carried safely.

The conditions under which the memorable flight was made again emphasize the caliber of American aviators. Just before victory was in sight, when the feed line from one of the emergency oil tanks broke and threatened to put an end to the attempt, Stinson removed his gauntlet in a temperature several degrees below zero and broke a hole in the emergency tank. This accomplished, he inserted a rubber hose and siphoned oil into the main tank. This act made the record possible, though it may cost Stinson three of his fingers from frostbite. That this repair was possible while in the air suggests how safe flying is becoming.

The flight itself is an answer to the oft repeated query, "What is the use of it?" From it invaluable data on engine performance, stresses and strains on the metal structure during severe weather and flying conditions generally have been gained that will have much to do with future design. Stinson and his companion not only added two full hours to the world's duration record, but they did it in winter, whereas the record they eclipsed was made in France in summer.

All honor to them!

Their success brings to this country the fourth world's record in aviation this year. On September 28, Lieutenant McCready established a world's altitude record by rising 37,800 feet above sea level. In November Bert Acosta established a world's speed record around a closed circuit by flying 150 miles at an average speed of 176.7 miles an hour, and in August, Lieutenant McCullough established a world's altitude record for seaplanes by ascending 19,500 feet.

The only outstanding world's record in aviation now held in any other country is that of straightaway speed over a measured course. This is held in France, and to eclipse it some American machine will be compelled to fly upward of 210 miles an hour, but American manufacturers are confident they will do it early in the coming year.—*Editorial in N. Y. Tribune.*

The most important aspect of the achievement is its bearing on commercial flying. Of course, distance flying and endurance flying are somewhat different affairs, yet the possibility of a day's flying in the one case has a direct application to the other. The lengthening of the endurance record means a strong possibility of lengthening the distance record. The lengthening of the distance record means, under present conditions, the ability to carry a larger fuel supply than ever before. This has in turn a relation to carrying capacity per horsepower unit. The Larsen record was not only an indication of the ability of aircraft to fly further than ever before, but also of their ability to take larger and larger loads, an important aspect of their development as commercial carriers.

—*N. Y. Globe.*

The exploit of the American aviators who beat the world's endurance record is more than a personal triumph. It shows the advance of flying in its most necessary department, for the quality more desirable than any other in planes is staying power.

When Alcock and Brown hopped the Atlantic they did the 2,000 miles in 16 hours, or 125 miles an hour. If Stinson and Bertaud had been flying eastward at this rate, instead of hovering over the Mineola Field, they could have gone from Long Island to Gibraltar in the 26 hours and 19 minutes that they were aloft.

The record breaking performance is thoroughly American in men and machinery. It beats the nearest European performance by two hours. It is the kind of aerial feat that is worth doing.—*N. Y. Herald.*

THE NEWS OF THE WEEK

No Ford Planes Immediately

A high official of the Ford Motor Company in Detroit, writing a party in New York, says: "Relative to the reports you mention about Mr. Ford bringing out an aeroplane-seaplane and possibly an airship, would say, that while he is considerably interested in this subject, there is no truth in the reports that he will become actively engaged in this line in the near future."

Some Fast Traveling in the Aerial Mail Service

Pilot Claire K. Vance of the Aerial Mail Service must have surely had some wind on the tail of his plane when, on November 21st he made the trip to Elko, Nevada, from Reno, Nevada, a distance of some 235 miles, in one hour and twenty minutes. There have been hints cast that Vance was a speed demon, and now it goes without saying.

To Increase Activities of Aerial Mail Service

Mr. Glenn L. Martin, of the Glenn L. Martin Co., Cleveland, Ohio, and Assistant Postmaster Shaunessey are expected at Crissy Field, Presidio of San Francisco, Cal., in the near future for a conference with Major H. H. Arnold, 9th Corps Area Air Officer, and other army officials. Much is looked for as a result of their conference in furthering the activities of the Aerial Mail Service and as a stimulant to the number of civilian flyers in the Bay region of San Francisco.

Aero Club of Minneapolis

The first issue of *Contact*, the official bulletin of the Aero Club of Minneapolis, is before us, and we congratulate the officers in getting out this medium of co-ordinating the information of its members.

The present officers of the Club are as follows:

R. R. Rand, Jr., President; Wm. F. Brooks, Vice President; Harry C. Piper, Treasurer; Paul Goldsborough, Secretary.

Directors: Wm. F. Brooks, John P. Snyder, Joseph Chapman, R. R. Rand, Jr., Matthew D. Crawford, Ray S. Miller, Murray K. Guthrie, V. F. Rotering, Glenn Traer, Charles S. Pillsbury, Isaac Hazlett, Guy A. Thomas, Paul W. Latham, F. B. Hubachek, R. G. Browning, Harry C. Piper, Lawrence W. Carpenter, Philip J. Barnes, H. M. Gardner, Earle Brown, F. A. Chamberlain, D. Draper Dayton, Vincent G. Dodds, Mark M. Hurd, Weldon Larrabee, R. G. Robertson, Douglas K. Kennedy, C. T. A. Hart, Rockwood W. Bullard.

Sioux City to Have First Corps Area Air Caucus

The aviation convention of the states comprising the ninth army corps area will be assembled in Sioux City on January 26th and 27th for the purpose of completing city, district and state air associations throughout the entire corps area. Delegates from each city, district and state will be in attendance, as well as officers of the National Air Association. Several men of national prominence in air navigation development are expected to be in Sioux City to take active part in the organization work, including H. E. Coffin, E. V. Rickenbacker, J. G. Vincent, Sidney D. Waldron, Col. E. H. Shaughnessy, Benedict Crowell, David Beecroft and E. A. Kelly. The convention is called and will be conducted under the jurisdiction of Rufus R. Rand of Minneapolis and John B. Coleman of Sioux City, who represent the corps area on the National Board of Governors. The committee in charge of preparations are C. B. Toy, J. L. Mitchell, C. B. Beck, E. R. Schultz, A. S. Johnson, E. C. Epely, Stanley G. Eaton, Ralph Oliver, Wilson Clark and John H. Kelly. Announcement of other committees will be made later.

The adoption of the slogan, "Air Navigation" will be featured at the convention, and among the exhibitions of great interest will be the motion pictures taken by the Government of the bombing demonstration off of Muscle Shoals, Alabama.

This convention is the first of its kind and is expected to be followed by corps area conventions throughout the entire United States.

Lack of Interest in Aviation Around New York Traced to Its Source

In preparing the aviation program for 1922, the Contest Committee of the Aero Club of America made an analysis of the aviation meets held in 1921 and found that in spite of the Secretary of War's order which reduced Government participation in aviation contests to practically nil, there were meets held in the following places: Kansas City, Omaha, Baltimore, Chicago, Kokomo, Ind., Dallas, Denver, Oakland and Long Beach, California, also in several cities in Iowa and one in Florida, supported almost entirely by privately owned planes.

In order to more intelligently direct the contest for 1922, the committee has been appealing, through the medium of aviation magazines, to the owners of aircraft to register. This request first appeared over a month ago, and since that time replies have been received from Massachusetts to Seattle, Washington, and from Southern California to Florida, but not one from a single aviation company around New York City, although there are at least twenty in this district, supposedly in the business of merchandising aircraft.

When the Pulitzer Trophy Race was held on Long Island in 1920, there was but one company which made entry and that was a foreign make of airplane, all other entries being made by the Government.

In view of this situation, the Contest Committee of the Aero Club of America does not see its way clear at this time to attempt to organize a meet in the vicinity of New York, without the knowledge of the number and types of aeroplanes available in that district, and in making this announcement suggests that the President and Board of Directors of the Aircraft Companies in the Metropolitan District give some thought to the merchandising efficiency of their organizations, as compared to that of other lines of business with which they may be associated.

CALEB S. BRAGG,
Chairman Contest Committee.

CALENDAR OF COMING EVENTS
under sanction of
AERO CLUB OF AMERICA

Annual Banquet Aero Club of America
Hotel Commodore, New York City,
7:30 Monday Evening, January 9, 1922
For members (who are entitled to bring guests) of
Aero Club of America, and affiliated Aero Clubs
Society of Automotive Engineers
Automobile Club of America
Automobile Club of New York
Motor Boat Club of America
New York Yacht Club
Tickets: $8.00

April 30th (1 or 2 days)
Spring Show and Opening Meet
Place: Curtiss Field, Mineola, L. I., N. Y.
Conducted by: Curtiss Airplane & Motor Corporation, Garden City, L. I.

September 4th (about) 1-day meet for
Detroit Aerial Water Derby
Curtiss Marine Trophy
Class Race Prizes
Invitation Races
Speed Trophy
Place: Detroit River and Lake St. Clair.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

September 15th (about) 3-day meet
Pulitzer Trophy
Detroit Aerial Derby
for Aviation Country Club of Detroit Trophy and Liberty Engine Builders' Trophy and Class Race Prizes
Invitation Races
Detroit News Aerial Mail Trophy
for Multimotored Aeroplanes Speed Trials
Place: Mt. Clemons Field, Detroit, Mich.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

August 15th (about)
In Preparation by the Aero Club of America
American Elimination Trials, if Necessary for La Coupe Deutsch de la Meurthe (Race to be held in France about October 1st. Place: Mitchel Field, Mineola, L. I., N. Y.

September 30th
First Annual Interservice Championship Meet
Open to the personnel of
The U. S. Army, Navy and Marine Corps Air Service
Championships in Single Seater Fighting Bombing Reconnaissance Races Photography Races Formation Flying, Etc.
Location: Mitchel Field, L. I., N. Y.

August 1st (about)
Foreign Events
Coupe Jacques Schneider
Contest for Flying Boats and Seaplanes
Place: Italy (probably Venice).
Conducted by: Aero Club d'Itali, 24 Via Tor de'Specchi, Rome.
American entries received by the Aero Club of America.

October 1st (about)
Coupe Henry Deutsche De La Meurthe Race for Aeroplanes
Place: France.
Conducted by: Aero Club of France, 35 Rue François-1, Paris.
American entries received by the Aero Club of America.

LARSEN PLANE ESTABLISHES WORLD'S ENDURANCE RECORD

FLYING continuously for 26 hours, 19 minutes and 35 seconds in gales, snow and a zero temperature, Edward Stinson and Lloyd Bertaud in a Larsen all-metal monoplane at Roosevelt Field, near Mineola, L. I., set a new world's record December 30, for sustained flight in a heavier-than-air machine. Averaging 85 miles an hour in circling above the flying field and surrounding country, the monoplane traveled at least 2,200 miles, or, translated into land distance, the equivalent of the Pacific gap between California and Hawaii.

Had the plane flown straightaway the pilots would have landed in Reno, Nev. The feat was all the more remarkable when it is compared with the previous endurance record of 24 hours, 19 minutes and 2 seconds made in France by Lucien Boussoutroy and Jean Bernard. Their flight was made on a clear day in June of last year after careful preparation. Stinson and Bertaud agreed to make the attempt for J. L. Larsen, designer of the plane, the day before the start of the flight.

Numb with cold and exhausted by lack of sleep, Stinson and Bertaud brought the monoplane down to earth at 11:17:50 o'clock A. M. December 30, They both maintained that they would have remained up several hours longer had they not been forced to descend by reason of a faulty oil connection with which they had been struggling since 3 o'clock in the morning.

Taxied Back to Hangar

When the J. L.-6, landed in the middle of Roosevelt Field within a few feet from where it took off the day before, Mr. Larsen, who had maintained a constant vigil, started out in his automobile to bring the two aviators to the hangars a quarter of a mile back, but Stinson and Bertaud stuck to their posts and "taxied" the plane to the hangar.

Both fliers were almost blinded by oil. Stinson staggered as he alighted, but Bertaud was able to muster up a grin for the army of photographers. Stinson had not left his seat in the open cockpit of the plane since 4 o'clock Thursday afternoon and Bertaud had found little time to enjoy the comfort of the limousine interior of the plane back of the pilot's seat. For the time both men were stone deaf.

"It's good to be able to walk again," said Stinson. "I'm nearly frozen. We could have staid up until dark. Too much oil; that was the trouble." Stinson held up his right hand. "Three fingers frozen!" he yelled at the top of his lungs. "One finger frozen on the other hand too. I'm going home to bed. I feel as if I would never get warm again."

Bertaud fared better, but he agreed that the cold had been "terrific." He too, expressed a desire to sleep, though he related his experience before leaving the field. Mrs. Stinson was on hand to greet her husband, and brought sandwiches, but "Eddie," as he is known to hundreds of army aviators whom he trained during the war, was too tired to eat. He left at once for his home in Hempstead. Describing the flight to newspaper men, Bertaud said:

"Our first four hours in the air yesterday were flown between fifty and seventy feet above the ground. The snowstorm raging then was so heavy that we could not go any higher and see the earth. We had to dodge church spires and chimneys frequently. Once when I was piloting the machine we almost hit the old chimney of the Camp Mills Hospital.

"Stinson and I did not do much talking until after we found we had been flying over twenty-five hours and knew that we had beaten the world's record. We both turned around in our seats and shook hands with each other.

"We encountered our first difficulty about 2 o'clock this morning, when the oil from the auxiliary tank began to thicken from the cold and would not feed well. We discussed the question as to whether we should land. We decided not to quit as long as the plane would remain in the air. We hit upon the plan of pouring the oil into the tank and not depending on the feed pipe.

Poured Oil in Tanks

"While one of us steered the other had to lift the five-gallon auxiliary oil cans, into which we had punched holes, in order to pour the heavy mixture into the tank. It was so thick that we could pour only about a quart at a time. Great care was required to keep the oil from running out, thereby burning out the bearings and destroying the motor. Incidentally, our hands, which had become numb just before midnight, got back some of their feeling with this strenuous work.

"Flying around and around the country was monotonous, especially after darkness set in. The fatigue from the cold was terrible. We did not dare to go to sleep for fear that we would become so chilled and numbed that when we awoke we would not be able to handle the plane. We had to maintain a constant vigil to keep the plane at an altitude where it would consume the least amount of gasoline.

"When we started on the flight the motor was turning up 1,400 revolutions per minute and when we landed it was 1,075 per minute. The motor under ordinary circumstances will consume about seventeen gallons of gasoline an hour. With the engine throttled down we used about twelve. The principal factors in a test of this kind are reliability, economy and good handling. During the night we never flew out of sight of the night flares at Roosevelt Field and Larsen Field, at Central Park, L. I. Sometimes during the long hours of the night we hovered over Freeport to vary the monotony.

"I have never flown more than twelve continuous hours before and I doubt if Stinson has. I do not care to try it again under such adverse weather conditions as we had on this occasion."

Ate Nothing in Flight

Bertaud said that neither he nor Stinson had eaten any of the food that they had taken along with them on the trip. They each drank a little hot coffee during the flight, he said. The J. L.-6 "took off" from Roosevelt Field at 8:58:15 on December 29 in a driving snowstorm. The two pilots took no particular precautions to protect themselves against the blustery weather, depending for warmth while in the air on a special heating arrangement in the cockpit, which led into the spacious interior compartment which had been fitted up comfortably with a bed.

Stinson wore a sweater and flying coat over a khaki uniform, while Bertaud was attired in a civilian suit and leather coat. The plane carried 2,200 pounds of gasoline and a gross load of about 5,300 pounds.

Seven judges appointed by the Contest Committee of the Aero Club of America acted as starters and watchers of the flight, working throughout the day and night in two-hour shifts. The judges were H. G. Scholler, W. M. Royse, H. G. Davison, L. Balch, R. B. Uber, Earl Holtham and H. Sushan.

In a shack heated by three oil stoves the judges watched the plane perform its endless encirclings. At nightfall three flares were lighted and kept burning until daylight to guide the airmen. At 9:20 yesterday morning the aviators had broken the world's record, but Stinson and Bertaud gave no indication of coming down. From that moment on it was simply an attempt to hang up a new endurance record.

American Made Throughout

J. L. Larsen, owner and designer of the monoplane, who has flown more than 300,000 miles in this country and Europe in J. L.-6's, said that in a sister plane of the one used yesterday he had traveled by air from the southern part of Mexico to within two hours' air distance of the Arctic Ocean and from Boston to San Francisco. "And the plane is all American made," he said. "Made in America by American workmen andof American material. I am happy to know that I have been able to capture another aeronautical record for the United States."

Mr. Larsen said he flew the record winner recently to the air meets at Kansas City and Omaha. The plane, constructed of duralumin throughout, has a wing span of fifty feet and a length over all of thirty-one feet. It stands eleven feet high. It is motored with a 185 horsepower B. M. E. engine and has an enclosed cabin seating six persons. Major Gen. Mason Patrick, Chief of the United States Air Service, sent a congratulatory message to Stinson last night.

"The Army Air Service," he said, "is pleased to extend to a former member its congratulations on the remarkable duration record just attained by you."

Augustus Post, Executive Secretary of the Aero Club of America, said the feat was but another demonstration of the possibilities of the aeroplane as a carrier of commerce. One did not have to look very far into the future to picture nonstop flights between New York and Chicago and other cities as a common every day occurance. The Aeronautical Chamber of Commerce, commenting on the flight in a statement said:

Fourth U. S. Record This Year

"This record, which is the fourth world's record to be achieved by America in 1921, focuses attention on the last day of the year to the great achievements in American flying. Eighteen years ago this month the world's first flight was made in an American machine, the duration being fifty-nine seconds—an unheard of accomplishment. In those fifty-nine seconds Orville Wright covered a distance of 852 feet. The other world's records made by America during the year were:

Altitude—Lieutenant J. A. McCready, U. S. A. S., on September 28, reached a height of 37,800 feet over McCook Field, Dayton, Ohio, in a Lepere biplane.

Speed—Bert Acosta, in a Curtiss-Navy Racer, flew at a speed of 176.7 miles an hour for 150 miles during the Pulitzer race at Omaha, Neb., November 3.

Efficiency—The Loening monoplane flying yacht, on August 16, reached a height of 19,500 feet with four persons over Port Washington, L. I., N. Y.

(Concluded on page 414)

The AIRCRAFT TRADE REVIEW

New Farman Sport Plane Shows Remarkable Performance

During the past week the personnel at Bolling Field were privileged to witness a sensational demonstration of the new Farman Sport Plane, piloted by former Captain Robertson of the Royal Air Force. This is the plane which created such a furore in aviation circles by its performance at Omaha. This tiny biplane, equipped with a 60 h. p. LeRhone motor, with a wing span of only 24 feet and a total weight of less than five hundred pounds, showed something new in range of speed, and goes far toward filling the need of a plane that can land and take off almost anywhere, besides being speedy and maneuverable. The maximum speed of this little fellow is rated at more than 90 miles per hour, and its normal speed ranges down to a landing speed of between 10 and 20 miles per hour, depending upon the wind. On this field, against a 12-mile wind, it landed in less than 50 feet, and took off in less than 60 feet, climbing at an angle of more than 45 degrees. Its maneuverability is unexcelled by anything ever seen at Bolling Field, and yet it cannot be made to spin. Its performance convinced everyone at the field that a real step forward had been made in the onward march of aviation.

West Virginia Field

A rectangular landing field 900 by 200 feet is located 1½ miles south of Charleston, near and parallel to the Kanawha River, long axis northwest-southeast.

The field contains a hangar and is marked with a '*T*.' Prevailing winds are from the southeast. High voltage telephone lines follow the road on the north side. In event of landing with too much speed it is possible to roll over the road to the southeast.

Colorado Landing Field

An emergency landing field has been established at Englewood, Colo., 4 miles south of Denver; the field is owned by Mr. J. M. Haldeman.

The field contains 80 acres with long axis north-south. The land is rolling, well drained, and free from trees.

A wire fence incloses the north, east, and south sides; telephone wire along the road on the north and east sides.

The altitude of Englewood is 500 feet.

Prevailing wind, southwest.

Gas and oil may be procured either from Denver or Littleton, both four miles distant.

Plan Air Line to Chicago

Daily passenger and freight aeroplane service between New York and Chicago in competition with railroads will be inaugurated as soon as planes can be completed, according to an announcement made by the Seaboard Consolidated Airlines, Inc., of 110 West Fortieth Street, of which Stanley E. Hubbard is President. One of the eight-passenger planes to be used has been completed, while the construction of others will be started immediately, it was said.

Details of the service have been worked out by aeronautical engineers who have studied the airlines of Germany and France. Airways to Pittsburgh, Cleveland, Albany and Montreal will also be developed. The time table calls for three trips daily each way to Chicago on an eight-hour schedule, with a rebate of $1 for every minute of delay.

The fare to Chicago will be $51.80, to Pittsburgh $20.30, and to Montreal $20; baggage limit, ten pounds. The planes will also carry 1,000 pounds of freight each at $1 a pound, according to Mr. Hubbard.

Forest Service Conference at Mather Field

A big Forest Service conference was held at Mather Field, Mills, Cal., during the latter part of November, which was attended by approximately fifty of the leading members of that service. The representatives from the National Headquarters were Chief Forester W. B. Greeley, with Messrs. R. Headley, Assistant Forester; E. W. Kelley, Fire Inspector; and C. E. Rachford, Grazing Inspector. District Foresters Fred Morrell from Missoula, Montana; A. S. Peck, Denver, Colo.; F. C. W. Pooler, Albuquerque, N. M.; R. H. Rutledge, Ogden, Utah; and Paul G. Redington, San Francisco, Cal., were present with their forest supervisors, fire specialists, chiefs of operation, fire assistants and the administrative assistants; men in charge of personnel and training; and men who look after public relations and make a specialty of research work in the interests of fire prevention.

A lengthy program was originally planned, but the important questions involved were so numerous that it was found necessary to hold sessions every evening as well as in the mornings and afternoons of each day, causing a considerable curtailment of the hospitality planned to be extended to the Forestry Service by the Command at Mather Field in the matter of social affairs.

In addition to the Federal Forestry representatives there were present Messrs. D. R. Cameron, Forest Inspector of British Columbia; Don Bruce, Professor of the University of California, and M. B. Pratt, Deputy State Forester of California.

The conference was brought to a close on November 26th and, although some of the members left earlier in the week, the majority remained until Saturday afternoon, when the few who had brought their cars started on motor trips home to San Francisco and points in Oregon and New Mexico, the balance leaving by train. The lecture delivered during the week by Mr. Paul G. Fair, Constructor of Exhibits of District No. 5, for the information of the foresters, was also attended by nearly everyone on the post. Aside from the entertainment afforded by the showing of attractively colored slides and the rather technical information given on the mounting of wild animals, many new ideas on the taking of photographs were gained. The conservation of animal life, is a part of the work of the Forestry Service, and Mr. Fair's talk was of practical help, or will be so, to many of the foresters when they get out in the field.

Mr. Fair's forestry exhibit at the Officers' Club has been a source of much interest and enjoyment to everyone. A harmonious background, painted, the foreground on the right burned off in a fire started by a lighted match carelessly thrown into dry brush, the middle area cleared by the forest rangers' work, thereby stopping the progress of the fire, and on the left side of the exhibit green trees, shrubs and bushes, making a safe retreat for the wild animals of the wood, together with two perfectly mounted specimens of young deer standing in the foreground, presented a very attractive picture. Many pictures taken by Mr. Fair, showing the cooperation between the Forestry and Air Services, have been hung in the club, temporarily, and excellently executed small models of campers with their properly equipped tent and correctly arranged camp fire have been erected.

The night before the foresters left they gave a stag party at the club to the officers of Mather Field, entertaining them with songs, recitations, impromptu speeches, etc. Clever cartoons, of both the foresters and officers, drawn by one of the former, occasioned much hilarity, but no wounded feelings. Refreshments were served during the entire entertainment, which did not break up until after twelve o'clock, and everyone attending pronounced the affair a huge success.

New Aerial Mail Hangar at Crissy Field

Mr. Caldwell, Air Mail Superintendent, has let the contract for a new hangar at Crissy Field. Work was begun on November 28th, and it is expected that construction will be completed and the hangar ready for occupancy in thirty days. The hangar now used by the Air Mail Service will be turned over for the use of the Reserve Squadrons now organizing in the vicinity of San Francisco.

(*Concluded from page* 413)

Stinson Trained Army Fliers

Edward Stinson and Lloyd Bertaud, both 27 years old, have long been identified with aeronautics. Stinson is credited with having trained more American fliers during the war than any other man. Barred from the army by reason of delicate health, he opened a field near San Antonio, Texas, as a civilian adjunct of the Air Service, and initiated the embryo airmen into the intricacies of "stunt" flying. When the war was over the Government awarded him a commission. As a "stunt" flier Stinson has few peers.

In his ten years' experience as an aviator he has never had a crash or broken any part of his plane. Stinson has two sisters, Catherine and Marjorie, who have made names for themselves as expert fliers.

Bertaud has had much experience as an aviator and instructor, and, piloting the plane used yesterday, he won the 140-mile American Legion Aerial Derby at Omaha in October.

AIRCRAFT INDUSTRY ORGANIZES CHAMBER OF COMMERCE TO POPULARIZE TRAVEL BY AIR

NEW YORK—Organization of the aircraft industry into a national body known as the Aeronautical Chamber of Commerce of America, with approximately 100 charter or founder members embracing the designing, constructing, operating and kindred elements, and representing virtually every section of the United States, was announced Dec. 30, at the Executive Offices, 501 Fifth Avenue. Among other things, it will develop the market and increase the use of flying machines among civilians, corporations and transportation companies.

The aircraft industry thus follows the example of all other modern industries which owe their present greatness in no small measure to the trade association. Organization of the Aeronautical Chamber of Commerce, following as it does the creation of the Bureau of Aeronautics in the Navy Department, and provision, in the Wadsworth-Hicks Bill, for a Commissioner of Civil Aviation in the Department of Commerce, and the nationalization and extension of the Aero Club of America, completes the accomplishments for the year and establishes the machinery whereby, it is believed, the development of American aviation will be greatly hastened.

The Aeronautical Chamber of Commerce of America is incorporated under the laws of the State of New York. Among its aims and purposes, as set forth in the Charter, are:

To foster, advance, promulgate, and promote trade and commerce, throughout the United States, its territories, possessions, and in foreign countries, in the interests of those persons, firms or corporations engaged in the business of manufacturing, buying, selling and dealing in aircraft, aircraft motors, and aircraft parts and accessories of every kind and nature.

To diffuse among its members accurate and reliable information as to the standing of its members and those persons, firms or corporations engaged in similar lines of business.

To procure uniformity and certainty in the customs and usages of trade and commerce among its members and those persons, firms or corporations having a common trade, business or professional interest in all matters pertaining to aeronautics.

To aid and assist in mapping out air roads and lanes; the location of landing fields, aerodromes, hangars, or such other structures as may be necessary for the advancement of aeronautics.

To advocate and promote in every lawful way the enactment of just and equitable laws . . . pertaining to aeronautics.

To settle, adjust and arbitrate any and all differences which may arise between its members, and persons, firms or corporations dealing with them.

To promote a more enlarged and friendly intercourse between its members, persons, firms and corporations engaged in the business of, or dealing in, aircraft, aircraft motors and aircraft parts and accessories, and generally to do every act and thing which may be necessary and proper for the advancement of the aeronautical art and industry and the accomplishment of the objects and purposes hereinbefore set forth; provided, however, that nothing herein contained shall authorize this corporation to engage in any business for pecuniary profit.

"The need for a central trade organization, including within its membership all of the responsible and permanent financial and professional interests in aviation in the country, has been felt for sometime," says a statement from the Aeronautical Chamber of Commerce. "The unsettled state of the industry, due at first to the tremendous burdens placed upon it in meeting the demands of wartime production, followed by the complete reorganization of the industry made necessary through the cessation of war contracts, has made it impracticable heretofore to bring this about.

"The existence of the Manufacturers Aircraft Association partly met the need. Its work has been characterized by a broad public-spirited attitude toward the entire industry and has been effective, but its members were the first to realize that an organization limited simply to manufacture aeroplanes, having, primarily, a common interest in the exchange of licenses for the use of patents, could not hope adequately to give representation to the entire field.

"After the Armistice, steps were taken to give consideration to the development of a broader and more inclusive body but, on account of the uncertainty of the future of many of the more important units in the industry, it appeared that the time was not opportune. A start was made, however, late in 1919, when Articles of Incorporation were issued. Following this, nothing definite was done beyond continuing the study of the situation and developing a general understanding and agreement relative to the details of such an organization. Study and consideration of these questions culminated a few weeks ago. At that time the plan was crystallized and submitted to representatives of all the various elements in the industry. It is now gratifying to be able to announce that the organization has been completed. Among its charter or founder members are found practically all of the responsible and representative men and organizations in this field. A glance at the list of members of the new organization will at once assure, it is believed, not only the successful future of the organization, but of its instant and important value of it to aviation and to the country.

"The new organization has taken over the offices and equipment of the Manufacturers Aircraft Association at 501 Fifth Avenue, New York City. The latter organization will continue to serve its members in handling the administration of the cross license agreement covering aeroplane patents. The Aeronautical Chamber of Commerce will assume and greatly extend all of the functions formerly handled by the older organization, including the collection and dissemination of information regarding aeronautical activities in this and other countries; the publication of the Aircraft Year Book; and the furnishing of special services to its members through its various department and committees.

"The new organization, including within its membership the principal constructors of aeroplanes and motors, as well as the manufacturers of accessories, instruments, materials and supplies, owners and operators of aircraft, various aeronautical trade papers and the principal engineers and designers, can be said to be truly representative of the aircraft art and industry in the United States.

"Aviation is a new and important element in our economic and social life and it is desirable that all of those having a permanent interest in the industry be thus brought together. Unification of interests in this important field will be of great significance, not only to the development of civil aviation but to the future security and general welfare of our country."

Among the founder or charter members are the following:

Aeromarine Airways, Inc., New York, Key West & Havana. By C. F. Redden, President.
Aeromarine Plane & Motor Company, Keyport, N. J. By I. M. Uppercu, President.
David Beecroft, New York. Directing Editor, Class Journal.
Luther K. Bell, New York. Of Manufacturers Aircraft Association, Inc.
L. W. Bettinger, New York. Of L. W. F. Engineering Company.
Bijur Motor Appliances Company, Hoboken, N. J. By Charles Marcus, Vice President.
Black, A. & D. R., New York. Aeronautical Engineers.
J. J. Boland, Keyport, N. J. Of Aeromarine Plane & Motor Company.
S. S. Bradley, New York. Of Manufacturers Aircraft Association, Inc.
Burnelli, Vincent J., Lindenhurst, L. I. Aeronautical Engineer.
John R. Cautley, Paterson, N. J. Of Wright Aeronautical Corporation.
A. J. Chalmers, New York. Publishers, Cine-Mundial.
Roland Chilton, Keyport, N. J. Of Aeromarine Plane & Motor Company.
Cox-Klemin Aircraft Corp., College Point, L. I. By Alexander Klemin.
Curtiss Aeroplane & Motor Corp., Garden City, L. I. By C. Roy Keys, Vice-President.
Curtiss Eastern Airplane Co., Philadelphia, Pa. By G. Sumner Ireland, President.
Glenn H. Curtiss, Garden City, L. I. Engineer.
Dayton Wright Company, Dayton, Ohio. By G. M. Williams, General Manager.
The Ralph C. Diggins Company, Chicago, Ill. By Ralph C. Diggins.
Donald Douglas, Los Angeles, California. Engineer.

The Douglas Company, Los Angeles, California. By Donald Douglas.
G. Elias & Bro., Inc., Buffalo, N. Y. By A. J. Elias, President.
Fairchild Aerial Camera Corp., New York. By Sherman Fairchild.
Sherman M. Fairchild, New York. Fairchild Aerial Camera Corp.
Albert H. Flint, College Point, L. I. Of L. W. F. Engineering Co.
A. J. Flochbar, College Point, L. I. Of L. W. F. Engineering Co.
Gallaudet Aircraft Corporation, East Greenwich, R. I. By J. K. Robinson, Jr., President.
Edson F. Gallaudet, East Greenwich, R. I. Engineer.
L. D. Gardner, New York. Publisher Aviation and Aircraft Journal.
W. L. Gilmore, Garden City, L. I. Curtiss Aeroplane & Motor Corp.
J. I. Hartness, College Point, L. I. L. W. F. Engineering Company.
Stewart Hartshorn Co., New York. By B. E. Bushnell, Sales Manager.
William Henry, Los Angeles, Calif. Of the Douglas Company.
George H. Houston, 60 Broadway, New York City.
G. Sumner Ireland, Philadelphia, Pa. Curtiss Eastern Airplane Corp.
Johnson Airplane & Supply Co., Dayton, O.
W. Wallace Kellett, Philadelphia, Pa. Representign H & M. Farman.
C. Roy Keys, Garden City, L. I. Curtiss Aeroplane & Motor Corp.
E. M. Laird Company, Wichita, Kansas. E. M. Laird, President.
J. L. Aircraft Corp., New York. John M. Larson, President.
Lawrence Aero-Engine Corp. By Charles Lawrence, President.
W. B. Lebherz, East Greenwich, R. I. Of Gallaudet Aircraft Corp.
L. W. F. Engineering Co., College Point, L. I. A. H. Flint, Vice-President.
Lewis & Vought Corporation, Long Island City, L. I. By Chance M. Vought.
Alfred P. Loening, New York. Of Loening Aero. Eng. Corp.
Grover C. Loening, New York. Of Loening Aero. Eng. Corp.
Loening Aeronautical Engineering Corp., New York. By Grover C. Loening, President.
Manufacturers Aircraft Association, Inc., New York. By S. S. Bradley, General Manager.
Hamilton Maxwell, New York. Aerial Photography.
George Meade, Paterson, N. J. Of Wright Aeronautical Corp.
National Aircraft Underwriters Assn., New York. By Edmund Ely, President.
New Jersey Veneer Co., Paterson, N. J. By F. F. Perrine, Treasurer.
R. B. C. Noorduyn, New York. Of Netherlands Aircraft Corp.
Ordnance Engineering Corp., Baldwin, L. I. By E. R. Michie.
Packard Motor Car Company, Detroit, Mich.
Park Drop Forge Company, Cleveland, Ohio. By Fred L. Ball, Treasurer.
Pioneer Instrument Company, Brooklyn, N. Y. By Charles H. Colvin, President.
C. G. Peterson, Paterson, N. J. Of Wright Aeronautical Corp.
H. L. Pope, Paterson, N. J. Of Wright Aeronautical Corp.
Otto Praeger, New York. Aerial Transportation.
J. F. Prince, Paterson, N. J. Of Wright Aeronautical Corp.
C. F. Redden, New York. Of Aeromarine Airways.
H. J. Reilly, New York. Publisher, Army and Navy Journal.
F. B. Rentschler, Paterson, N. J. Of Wright Aeronautical Corp.
J. K. Robinson, Jr., New York. Of Gallaudet Aircraft Corp.
John M. Rogers, Paterson, N. J. Of Wright Aeronautical Corp.
Foster Russell Aviation Co., Spokane, Washington. By Foster Russell.
Frank H. Russell, Garden City, L. I. Of Curtiss Aeroplane & Motor Corp.
R. W. Schroeder, Chicago, Ill. Of Underwriters' Laboratories.
A. R. Small, Chicago, Ill. Of Underwriters' Laboratories.
Lawrence Sperry, Farmingdale, L. I. Of Lawrence Sperry Aircraft Corp.
Lawrence Sperry Aircraft Corp., Farmingdale, L. I. By Lawrence Sperry, President.
Stout Engineering Laboratories, Inc., Detroit, Mich. By William B. Stout, President.
J. P. Tarbox, Garden City, L. I. Of Curtiss Engineering Corp.
Robert G. Thach, New York, 120 Broadway.
Ralph Upson, New York. Engineer.
Valentine & Company, New York. By L. B. Valentine, Vice-President.
Adrian Van Muffling, New York. Aeronautical Engineer.
J. G. Vincent, Detroit, Michigan. Of Packard Motor Car Company.
Chance M. Vought, Long Island City, L. I. Of Lewis & Vought Corp.
G. Douglas Wardrop, New York. Editor, Aerial Age Weekly.
George S. Wheat, Paterson, N. J. Of Wright Aeronautical Corp.
G. M. Williams, Dayton, Ohio. Of Dayton Wright Company.
Wright Aeronautical Corporation, Paterson, N. J. By F. B. Rentschler, President.
W. W. Wyman, Chicago. Of C. L. Maguire Petroleum Co.
Paul Zimmerman, Keyport, N. J. Of Aeromarine Plane & Motor Co.
Henry M. Crane, New York City.
Thomas Morse Aircraft Corp., Ithaca, N. Y.
F. L. Moore, Ithaca.
Albert Champion, Champion Ignition Co., Flint, Mich.
Boeing Airplane Co., Seattle, Wash.
E. N. Gott, Seattle, Wash. Of the Boening Airplane Co.
I. M. Uppercu, New York. Of the Aeromarine Plane & Motor Co.
C. F. Kettering, Dayton, Ohio. Of the General Motors Corp.
W. B. Stout, Dayton, Ohio.
Orville Wright, Dayton, Ohio.
H. E. Talbot, Jr., Dayton, Ohio. Dayton Wright Co.
Perry Austin Co., Grasmere, Staten Island.

AIR PHOTOS TO AID CITY DEVELOPMENT

Arcadia, Cal.—New fields in engineering studies are being opened at the army balloon and airship school at Ross Field here, in the department of plotting from photographic maps, according to officers of the recently reorganized school. The plotting study room is equipped with an enormous photographic map embracing 250 square miles of territory, almost to Los Angeles, of which Arcadia is the center. The map is a mosaic of several thousand photographs, taken by balloon or airship from an altitude of 500 feet.

As a result of these studies by the Langley Field, Va., and Arcadia school, the two great airship schools of the Army Air Service, a number of cities are planning to use aerial photographic maps in connection with city planning, traffic control, street widening and fire protection work, according to army officers.

Other uses to which photographic maps are being put are preliminary investigations of watersheds, hydroelectric developments, highway, railroad and canal location, forest surveys and various engineering works.

Army air officers have perfected automatic timing of exposures to cover the proper ground area and at the same time secure the necessary overlap for the accurate fitting together of individual negatives. This permits taking of pictures from the moving airship or aeroplane. Lenses have been discovered especially adapted for this type of work, and the officers have developed the technique covering such details as the best height from which to take pictures for specific purposes, speed of aeroplane and maintenance of level flight to insure verticality of view. The maps now produced by air service photographers, according to officers, attain a high degree of accuracy and wealth of valuable detail.

Aerial photography is among the subjects taught at the Ross Field school. Air Service officers point out that among points of particular value to engineering to be found in aerial photography are the speed with which such maps may be produced, ability to cover territory inaccessible on foot, comparatively low cost and impossibility of omitting any feature of the area photographed.

The mosaic map, army officers say, does not mean transit, stadia and plane-table are in the discard, but that engineering surveys made solely by these time-tried instruments will be out of date.

THE CHOICE OF WING SECTIONS FOR AEROPLANES

EDWARD P. WARNER

Secretary, Committee on Aerodynamics National Advisory Committee for Aeronautics.

(Technicol Note National Advisory Committee for Aeronoutics)

EVER since the use of wind tunnels first began to give some sort of quantitative data on the comparative performance of aerofoil sections, there has been warm dispute as to the best methods of treating the data thus obtained, and as to the most useful criteria for judging the relative merits of various sections. Although scores of such criteria for comparison have been devised and have been advocated with enthusiasm by their inventors, none of them have gained universal acceptance, and indeed, it is evident that there can be no single formula for judging the aerodynamic merits of wing sections, even if structural considerations be left out of reckoning entirely. The factors entering are far too numerous, the conditions under which the wings have to work on different types of aeroplane are too diverse to permit of the deduction of any single formula which will automatically point the way to the best section in all cases.

The subject of choice of section is by no means a closed one, and despite the impossibility of making a single rule serve, it is quite practicable to deduce in a strictly rational manner a series of rules and formulas which are capable of being of the greatest use if we but confine ourselves to the consideration of one element of performance at a time.

There are seven such elements of performance which may be taken up in turn, the seven being of different relative importance in different types of aeroplanes. They are:

(a) Maximum speed, regardless of minimum
(b) Maximum speed for given minimum
(c) Maximum speed range ratio
(d) Maximum rate of climb
(e) Maximum absolute ceiling
(f) Maximum distance non-stop
(g) Maximum duration non-stop.

Each of these in turn will be treated separately. (a) and (b) obviously cannot both apply to the same airplane, (a) really being applicable only to racing aeroplanes which are always to be landed on good fields and where the landing speed can accordingly be increased to abnormally high figures.

A. *Choice of Wing Section for Moximum Speed, Regardless of Minimum.*

If the design is to be made with maximum speed as the sole desideratum, obviously the sole requirement is that the drag shall be as small as possible, and since the loading and area can be adjusted so that the aeroplane will fly at maximum L/D at maximum speed this is equivalent to choosing for maximum L/D alone. Flying at maximum speed at maximum L/D, however, entails landing at about 70% of the maximum speed.

In the more common case where a minimum area is initially fixed and the best wing section is to be chosen for that area and a given weight, it is necessary to take account of the power and weight in order to determine the angle of attack at which the aeroplane flies at maximum speed. At maximum speed

$$C_L V^2 = \frac{W}{S\frac{\rho}{2}} \text{ and } (C_D S + C_R)\,\frac{\rho}{2}\,V^3 = 550\,\pi$$

where C_R is the coefficient of parasite resistance for the whole aeroplane, P the engine horsepower, and π the propeller efficiency. V is the speed in feet per second and S is given in square feet. If we assume that the parasite resistance is one-half of the total resistance at maximum speed and that the propeller efficiency is 80%, the second equation becomes:

$$2\,C_D \frac{\rho}{2} S\,V^3 = 440\,P$$

$$C_D V^3 = \frac{440\,P}{\rho\,S} = \frac{186{,}000\,P}{S}$$

From the equation of lift

$$V = \sqrt{\frac{W}{\frac{C_L \rho S}{2}}}$$

Combining the last two equations, at maximum speed

$$C_D \left(\frac{W}{\frac{C_L\,\rho\,S}{2}}\right)^{3/2} = \frac{440\,P}{\rho\,S}$$

$$\frac{C_D^2}{C_L^3} = \frac{(440)^2\,\rho\,P^2\,S}{8\,W^3} = \frac{57.5\,P^2\,S}{W^3}$$

a relation which makes it possible to determine approximately the conditions under which a wing will work at maximum speed of a given aeroplane without the necessity of making detailed performance calculations in advance.

The object is to secure as high a wing efficiency as possible at the maximum speed of flight, or, since resistance is equal to weight divided by L/D, to secure a maximum L/D at a prescribed value of $\frac{C_D^2}{C_L^3}$. The choice of a wing for maximum speed with a given area can therefore be made by plotting L/D against $\frac{C_D^2}{C_L^3}$ for several aerofoils. The best wing section is that which has the largest ordinate at an abscissa equal to $\frac{57.5\,P^2\,S}{W^3}$, for conventional types. On cantilever-wing designs and others where it is evident that the parasite resistance is less (or more) than one-half the total the constant may be modified accordingly. In cantilever racing monoplanes, for example, 85 may be used instead of 57.5. In comparing sections for a given design, however, the same constant should always be used throughout.

In order to illustrate the use of this method, curves of L/D against $\frac{C_D^2}{C_L^3}$ for a number of sections are plotted in Fig. 1. Taking, for example, the case of a 300 HP pursuit aeroplane weighing 2,500 lbs. and having 240 square feet of wing surface, $\frac{57.5\,P^2\,S}{W^3} = .0795$. Erecting a vertical on Fig. 1 at this abscissa, it is clear that the best results are given by the U. S. A. 16, 17, and 21, and the R. A. F. 15.

B. *Choice of Wing Section far Moximum Speed with a Given Minimum.*

This case may also be treated in two different ways, depending on whether or not allowance is made for change of weight with changing area. We shall first assume the weight to be fixed independently of wing section and area.

In this case, the wing loading is at once given by the equation:

$$W = C_{L\,\text{max.}}\,\frac{\rho}{2}\,S\,V^2_{\text{min.}}$$

At maximum speed, just as in case (A):

$$\frac{C_D^2}{C_L^3} = \frac{57.5\,P^2\,S}{W^3}$$

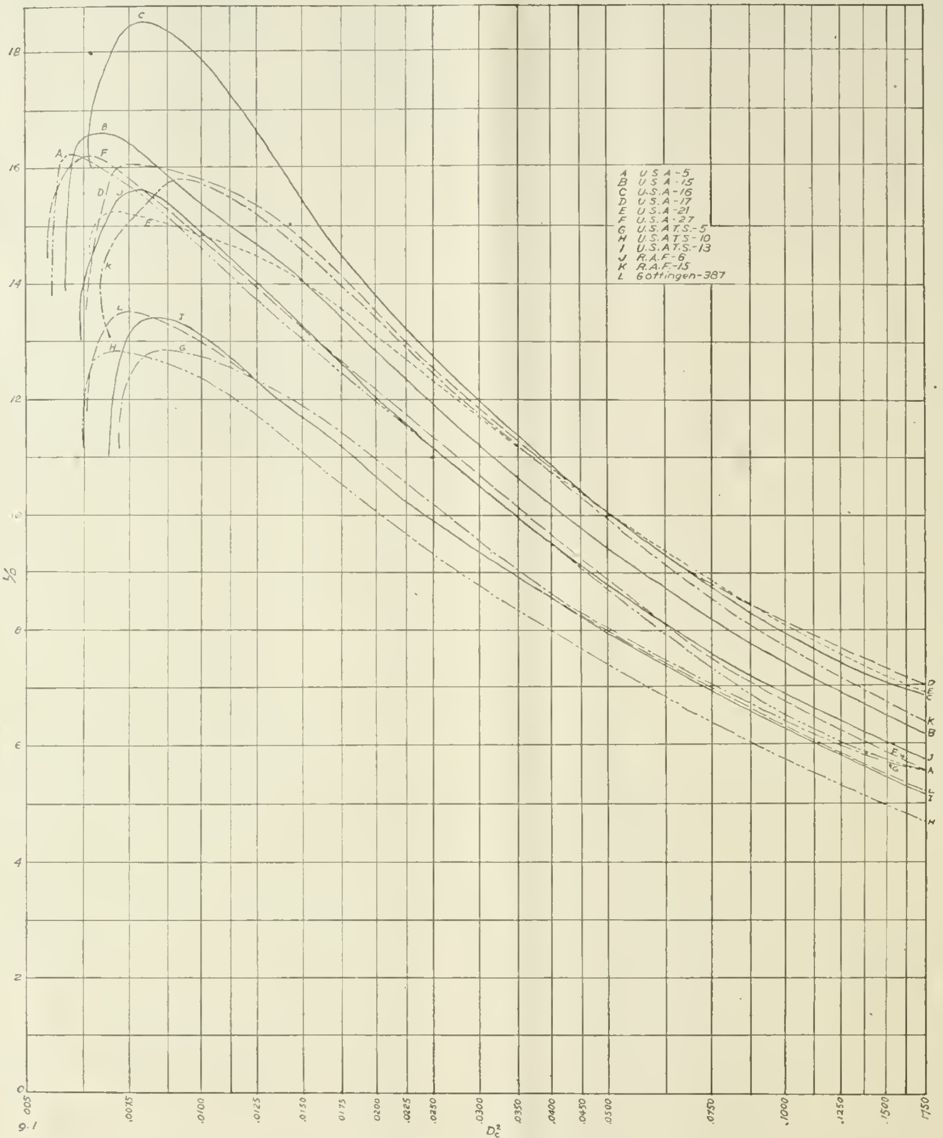
but S is now a variable and can be eliminated by using the equation of landing speed.

$$\frac{W}{S} = C_{L\,\text{max.}}\,V^2_{\text{min.}}$$

$$\frac{C_D^2}{C_L^3} = \frac{57.5\,P^2}{C_{L\,\text{max.}}\,V^2_{\text{min.}}\,W^2 \times \frac{\rho}{2}} = \frac{48400}{C_{L\,\text{max.}}\,V^2_{\text{min.}}\,W^2\,\frac{\rho}{2}}$$

Taking the square root of each side.

$$\frac{\frac{C_L}{C_D}}{\sqrt{\frac{C_{L\,\text{max.}}}{C_L}}} = \frac{\frac{W}{P} \times V_{\text{min.}}}{220}$$



The wing giving the lowest resistance at maximum speed under these conditions can therefore be found by plotting L/D against

$$\frac{L/D}{\sqrt{\frac{C_{L\max.}}{C_L}}}$$

and noting the ordinates at the point where the abscissa is 1/150 of the power loading times the minimum speed, or, alternatively, by plotting against $\frac{C_D{}^2}{C_L{}^3}$ and comparing the L/D ratios at the points where the abscissa is equal to $\frac{48{,}400\ P^2}{C_{L\max.}\ V^2_{\min.}\ W^2}$, this abscissa being different for different wing sections.

As an illustration of this method, the same problem may be used as was employed in case (A), specifying a minimum speed of 50 m. p. h. in place of an area of 240 square feet.

Tabulating the results for the several wings:

Name		$C_{L\max.}$	$\frac{48{,}400\ P^2}{C_{L\max.}\ V^2_{\min.}\ W^2}$	L/D
U. S. A.	5	1.290	.1005	6.59
	15	1.184	.1093	7.28
	16	.992	.1304	7.38
	17	1.082	.1199	7.81
	21	.913	.1419	7.34
	27	1.411	.0918	7.03
U. S. A. T. S.	5	1.512	.0858	6.81
	10	1.732	.0747	6.46
	13	1.294	.1003	6.34
R. A. F.	6	1.200	.1080	6.78
	15	1.109	.1161	7.40
Göttingen	387	1.640	.0792	6.93

The comparisons so far, based on the assumption that the wing drag is a fixed proportion of the total, indicate that the ratio of effective parasite resistance surface (equivalent flat plate area) to wing area is larger in the case of a thick wing with a large drag coefficient than in the case of a thin wing. This conclusion is correct in respect to the fuselage, the resistance of which decreases proportionately less rapidly than does

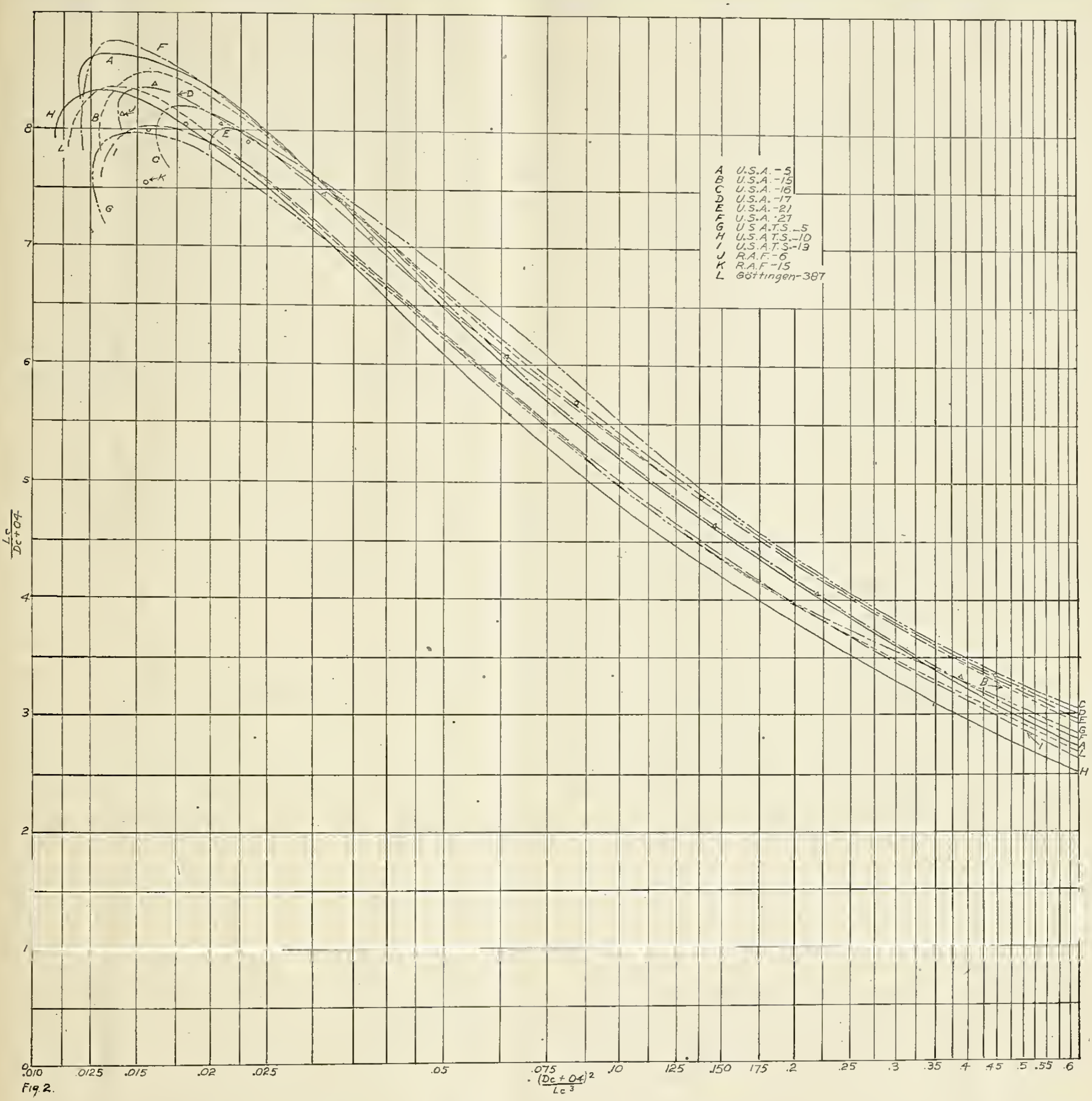


Fig. 2.

the wing area when the latter is changed. The resistance of the interplane bracing, however, is generally a much smaller fraction of the wing drag for thick wings with high drag coefficients than for thin sections. The method employed is, on the whole, unfair to the thick sections. A possible alternative is to use $\frac{C_L}{C_D + .04}$ instead of L/D, as a criterion of efficiency, assuming that the parasite resistance for the whole aeroplane is $.04 \frac{\rho}{2} S V^2$ in all cases, A being the wing area. It can readily be shown that, on this assumption, $\frac{(C_D + .04)^2}{C_L^3} = \frac{230 P^2 S}{W^3}$, $\frac{C_L}{C_D + .04}$ must therefore be plotted against $\frac{(C_D + .04)^2}{C_L^3}$. This has been done for 12 sections in Fig. 2. In order to avoid confusion among the large number of curves, the R. A. F. 6 and 15 have been indicated by points only. On the whole, this method of comparison is fairer than that previously described, especially where sections of widely varying thickness are to be compared. It will be noted, however, that the conclusions drawn from Figs. 1 and 2 are not very different, the relative rank of the sections being much the same except that the thick sections show up better by the method of Fig. 2.

As a specific example, the problem just solved by the first method will be treated by using Fig. 2. The numerical value of the abscissa for each section must then be just four times as high as in the first case, and the corresponding efficiencies are as tabulated below.

	Section	$\frac{C_L}{C_D + .04}$
U. S. A.	5	3.25
	15	3.33
	16	3.23
	17	3.29
	21	3.09
	27	3.39
U. S. A. T. S.	5	3.46
	10	3.32
	13	3.16
R. A. F.	6	3.23
	15	3.33
Göttingen	387	3.45

The six best sections by the two methods, arranged in order of merit, are:

Rank	By Fig. 1		By Fig. 2	
1	U. S. A.	17	U. S. A. T. S.	5
2	R. A. F.	15	Göttingen	387
3	U. S. A.	16	U. S. A.	27
4	U. S. A.	15	R. A. F.	15
5	U. S. A.	21	U. S. A.	15
6	U. S. A.	27	U. S. A. T. S.	10

Turning now to the derivation of a formula to take account of the change in weight with varying area, it can be shown that the total weight of an aeroplane is approximately proportional to $S^{1/6}$, other things being equal, where A is the wing area.

The equation of maximum speed then becomes:

$$\frac{C_D^2}{C_L^3} = \frac{57.5\ P^2\ S}{(K\ S^{1/6})^3} = \frac{57.5\ P^2 \sqrt{S}}{K^3}$$

If W_o and S_o represent the initial weight and the corresponding area for some particular wing section,

$$W_o = K\ S_o^{1/6}$$

$$K^3 = \frac{W_o^3}{\sqrt{S_o}} = W_o^{5/2}\ V_{min.} \sqrt{\frac{C_{L max.}\ \rho}{2}}$$

Since the $C_{L max.}$ in this last equation relates to a particular wing section, that for which W_o and S_o are taken, it must be a constant. Taking 1.3 as an average value of $C_{L max.}$ and substituting, and then combining the last two equations,

$$K^3 = .039\ W_o^{5/2}\ V_{min.}$$

$$\frac{C_D^2}{C_L^3} = \frac{57.5\ P^2 \sqrt{\frac{2\ W}{C_{L max.}\ \rho}}}{.039\ V^2_{min.}\ W_o^{5/2}} = \frac{42{,}800\ P^2 \sqrt{\frac{W}{C_{L max.}}}}{V^2_{min.}\ W_o^{5/2}}$$

Neglecting the small difference between $\sqrt{W}$ and $\sqrt{W_o}$ in any particular case, this becomes:

$$\frac{C_D^2}{C_L^3} = \frac{42{,}800\ P^2}{\sqrt{C_{L max.}}\ V^2_{min.}\ W_o^2}$$

In this case, since the weight is not a constant, it does not suffice to compare values of L/D.

Resistance at maximum speed

$$\frac{W}{L/D} = \frac{K\ S^{1/6}}{L/D} = \frac{K\ W^{1/6}}{L/D \times V^{1/3}_{min.}\ C_L{}^{1/6}{}_{max.} \left(\frac{\rho}{2}\right)^{6/1}}$$

Neglecting the small changes which would occur in $W^{1/6}$, it becomes apparent that the minimum total resistance for a given weight power and minimum speed is given by the wing which has the largest value of $L/D \times \sqrt[6]{C_{L max.}}$ at the point where

$$\frac{C_D^2}{C_L^3} = \frac{42{,}800\ P^2}{\sqrt{C_{L max.}}\ V^2_{min.}\ W^2_o}$$

Since $C_{L max.}$ has a single definite value for each section, this comparison, like the preceding one, can be made by plotting L/D against $\frac{C_D^2}{C_L^3}$, the ordinate being read off at the appropriate abscissa for each wing section and each ordinate so determined being multiplied by $\sqrt[6]{C_{L max.}}$

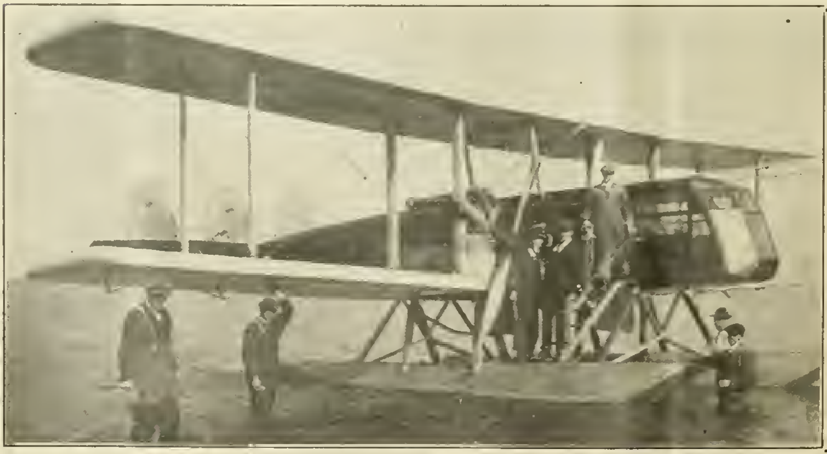
(To be continued)

DAYTON WRIGHT MODEL FP-2 SEAPLANE

THE Dayton Wright Company early appreciated the fact that one of the most practical and profitable uses of the aeroplane lay in its many advantages as a means of making accurate photographs and maps quickly, and at a minimum amount of expense. It was at once realized that the topographical features of the great forest districts of Canada were such as to make surveying and mapping by land slow and expensive, and it was also realized that the many bodies of water scattered throughout the country made it ideal terrain over which to operate seaplanes. The Engineering Department of this company thereupon set about the design of a plane specially for this purpose and which would be ideally adapted for aerial photographic work and timber spotting in the Canadian forest district. It was first necessary to study the actual conditions, and, with this end in view, a pilot from this company spent an entire season carrying on work of this nature in Canada. With the practical results obtained from this experience at hand, the Engineering Department developed the Dayton Wright model FP-2.

It was of course necessary to build a water ship, and the float type was selected as more desirable than the boat type, because of its greater ability to maneuver quickly in tight places. In order to minimize the danger of forced landings from motor trouble, the plane has been equipped with two Liberty engines, which give a sufficient normal excess of power, that level flight can be maintained with one engine, should the other, for any reason, become incapacitated. Two motors were also found desirable, inasmuch as a sufficient amount of power was necessary to enable the ship to get off in as short a space as possible. In its test flights, the FP-2 took off in the extraordinarily quick time of twenty-two seconds.

In order to successfully carry out observation work and photography, the occupants must have unrestricted vision to the front, to the sides and below. This has been amply accomplished in the FP-2 by placing them well forward in the nose of the fuselage, and providing ample window space. Another matter of prime importance in successful photography is steadiness of flight, and the designers have been so successful in obtaining this that the plane will maintain its course



The Dayton Wright Model FP-2 Seaplane

with the pilot's hands off the controls. The camera is universally mounted, so that any angle which the plane may take, the camera is always vertical.

Provision has been made so that the crew can be self-sustaining on exploration trips into isolated territories. The cabin is large enough for bunks to be installed in the rear, and sufficient provisions and equipment carried for trips of many days' duration.

We feel that this plane will fill the long felt want, and that many miles of territory will be mapped, and much valuable information will be obtained by its use after the flying season opens next Spring in Canada.

While the Canadian work has been stressed, the FP-2 is of course an ideal photographic ship and will find its market wherever mapping and photographing are required near bodies of water.

Dimensions & Specifications—FP-2

Model: Dayton Wright FP-2.

Type: Twin motor, twin float, biplane.

Use for which designed: Aerial photography and timber spotting.

Overall dimensions: Length, 36′ 10¼″; height, 14′ 0″; width, 51′ 5″.

Carrying capacity: Crew, four; equipment, camera and films, map table, folding canoe, fire extinguisher, axe, etc.

Power plant: Engines, 2 Liberty "12" 421 H. P. each; propellers, 2 tractor, 4 bladed, 8′ 9″ diameter; gasoline, gravity feed, 140 gallons.

Wing data: Chord, (both wings) 84″; span, (both wings) 51′ 5″; incidence, (both) to propeller axis, 2°; gap, 92-½″; stagger, none; sweepback, none; dihedral, 2°; wing section, U. S. A.-27.

Area: Wings, (total, including ailerons) 668 sq. ft.; ailerons, (total, four) 88 sq. ft.; stabilizer, 53.8 sq. ft.; elevators, 29.0 sq. ft.; vertical fins, (three) 20.8 sq. ft.; rudders, (three) 28.7 sq ft.

Weights: Empty aeroplane, 5,726 lbs.; gasoline and oil, 916 lbs.; total useful load, 1,862 lbs.; total gross load, 7,588 lbs.; power loading, 9.02 lbs. per h.p.; wing loading, 11.35 lbs. per sq. ft.

Performance: High speed at sea level, 120 m.p.h.; landing speed, 63 m.p.h.; climb to 5,000 ft., 9 minutes; service ceiling, 18,000 feet; flight range, (at high speed) 250 miles; flight range, (at ecn. speed) 325 miles; time to take off from water, 22 seconds.

A MECHANICAL DEVICE FOR ILLUSTRATING AEROPLANE STABILITY

By F. H. NORTON

(Technical Note National Advisory Committee for Aeronautics)

Summary

An instrument is described which will illustrate completely in a qualitative sense the longitudinal stability characteristics of an aeroplane. The instrument is primarily of use for the lecture room, but it is hoped that ultimately it will be possible to obtain quantitative results from it.

Introduction

It is a very simple matter to construct a piece of apparatus which will show dynamic stability or damped oscillations—for example, a pendulum. A simple device which can be altered to give any degree of stable or unstable motion has long been desired, and as far as it is known, the instrument described below is the only simple method for accomplishing this.

At first it was expected that only the degree of damping of an oscillation would be illustrated, but as the instrument was more carefully studied it became evident that nearly every property of the flying aeroplane was represented with astonishing exactness. This is confirmed by the fact that the equations of motion work out in almost identical form with those of Bryan and Bairstow for the aeroplane.

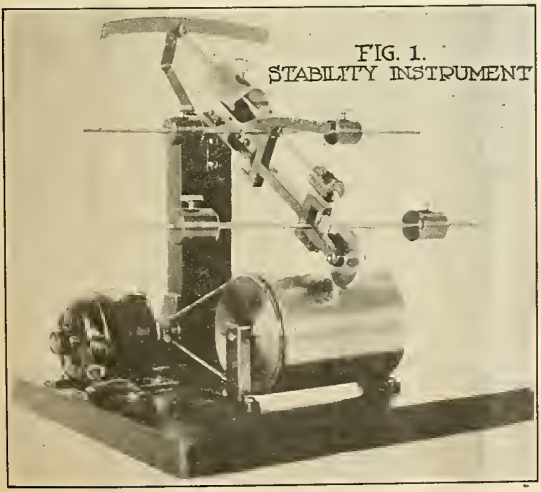


FIG. 1. STABILITY INSTRUMENT

A description of this instrument is given here because: first, it should be of interest to lecturers on aeronautics; second, it will allow mathematicians to visualize the actual behavior of an aeroplane without having to make flights; and third, it holds the possibility of mechanically solving the stability equations.

Description of Instrument

A complete view of the instrument is shown in Fig. 1. It consists essentially of a double pendulum, the lower end of which is a wheel resting on a revolving drum as shown diagramatically in Fig. 2. The drum can be turned at any speed by an electric motor, and the stability and moment of inertia about the two pendulum axes can be varied at will. The properties of the aeroplane are represented in the following way:

1. The restoring moment about axis (A) is the pitching moment about the C. G. of the aeroplane and represents static stability or metacentric height.
2. The restoring moment about axis (B) is the damping of the aeroplane—M_q.
3. The moment of inertia about (A) represents the mass of the aeroplane.
4. The moment of inertia about (B) represents the moment of inertia of the aeroplane about the Y-axis.
5. The angular motion about (A) represents changes in air speed along the path — V.

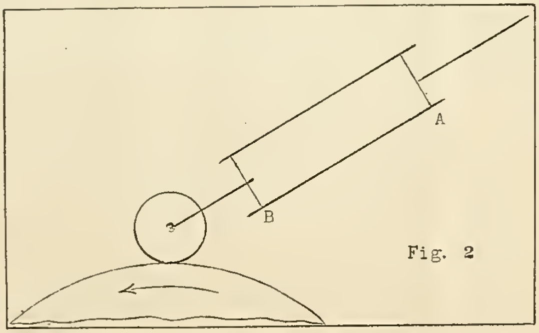


Fig. 2

6. The motion about (B) represents changes in inclination of the machine in respect to the horizon.

7. The angular movement of the wheel in relation to the drum axis represents the inclination of the path with the horizon.

Just why the above representation is true can not be explained at present, but from actual trial the instrument does behave in this manner. The speed of rotation of the drum has some influence on the characteristics of the motion, but just what this effect is has not yet been determined.

By adjusting the upper balance weight, any degree of static stability may be obtained and the change from an oscillation to a divergence is clearly illustrated. The oscillation is more stable (greater damping) when either the mass of the aeroplane (upper lateral weights) is increased or the moment of inertia (lower lateral weights) is decreased as indicated by theory.* The damping is also varied by changing the moment about the lower axis.

An oscillation can be produced which is stable below a certain magnitude and unstable above it. It is also possible to produce an oscillation which will damp down to a finite value and remain there permanently. This is particularly interesting as the same phenomenon has been observed in actual flight.

This particular design of instrument has the disadvantage that the moment of inertia about each axis is changed at the same time as the restoring moment so that the two effects are combined. This can easily be remedied by the use of springs instead of weights, and will be so changed in another instrument.

Theory of the Instrument

Instrumental records taken in flight of the air speed and path angle during an oscillation of constant amplitude show that these variables are, as closely as can be determined, sine functions of the time, but are of course at a small phase difference. The path of the aeroplane in space can not be a sine curve, but in stability calculations the amplitude has been assumed so small that the departure from it is negligible. By assuming small oscillations, angles may be used in place of sines of angles and the usual theory of Bryan and Bairstow can be applied. Working in the same way, W. P. Angel has carried out an analysis of this instrument which gives equations of the same form as for the aeroplane. In both cases however the oscillations are assumed small and so can not apply strictly to the actual conditions. It is felt that if an exact solution can be made of the motion of this instrument, we shall have at the same time the exact solution of the aeroplane motion. It is hoped that mathematicians will interest themselves in this problem.

Uses

This instrument is useful for making visible the very complex behavior of the aeroplane during an oscillation. In several instances new facts were observed on the instrument and later checked in flight. It can also be used for illustrating in the classroom or lecture hall the effect on stability of making changes in the various characteristics of the aeroplane.

It is hoped that this instrument may be used quantitatively to determine the type of oscillation for a new aeroplane, by settling the characteristics (mass, moment of inertia, damping, etc.) of this aeroplane on the graduated scales of the instrument. Whether this can be done or not is difficult to predict but experiments along this line will be carried out.

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* Thomson, "Applied Aerodynamics", p. 208.

COST FIGURES ON OPERATING AEROMARINE FLYING BOAT PASSENGER AND MAIL SERVICE

Extracts from Address of C. F. Redden, President Aeromarine Airways, Inc., Before Metropolitan Section, Society of Automotive Engineers

JUST as the automobile opened up the rural districts and made it possible for a business man to live twenty miles from his office and motor into town, so will the aircraft ultimately extend that zone of population from twenty miles to one hundred miles, and homes will be built on the shores of lakes and rivers and in inaccessible mountainous districts that are now practically worthless except for camp sites.

Eighteen months ago we inaugurated a passenger-carrying service around New York, up and down the Sound and from New York to Atlantic City. After five months' operation we felt justified in enlarging our operating organization, and on November 1st of last year a fleet of six 11-passenger converted Navy boats inaugurated a daily mail and passenger service between Key West and Havana, flying across one hundred miles of open seas, also between Palm Beach, Miami, Bimini and Nassau. Although the Havana harbor is probably one of the most difficult points on the map from which to operate, and notwithstanding the fact that neither Key West nor Havana affords any particular commercial advantage, when compared with industrial centers such as New York and Chicago, or Detroit and Cleveland, the service is officially recognized as a desirable means of travel.

This service has proven beyond any question of a doubt that a commercial line between such points as Cleveland, Detroit or other cities similarly located would prove not only profitable but would meet a great public need. During the past year our fleet of fifteen boats has flown nearly 100,000 miles. They have carried 6,814 passengers and 29,002 pounds of freight and mail, and without a single serious mishap.

This distance from Key West to Havana is approximately one hundred miles, yet we make the flight in one hour and fifteen minutes—the time by seamboat is approximately ten hours, and, due to the roughness of the Gulf Stream, it is not always a pleasant passage.

Last spring we sent one of our 11-passenger flying boats, the Santa Maria, on a trip from Key West to New York, to Montreal, down the St. Lawrence to Toronto, to Buffalo, Detroit, Mackinaw and Chicago, thence down the Mississippi River to New Orleans, and then back to her base at Key West. This was the longest commercial aeroplane flight ever taken. We made a stop at practically every ctiy and town of any importance en route. We would come down in a more or less unknown and uncharted harbor where no provision whatever had been made for our direction or convenience—we would take on fuel, take a few passengers for sightseeing hops, and then "take off" to come down again in some other strange harbor. This flight covered a little over 7,000 miles, at an average speed of seventy-five miles per hour, with no special roundhouses, bases or service stations en route. If you tried to equal this record of speed and endurance with a modern locomotive traveling on smooth rails and with every device for its protection and safety and a roundhouse every two hundred miles, you would probably have nothing but a heap of junk at the end of the trip.

Another converted Navy boat with a single Liberty motor was sent on a passenger-carrying trip from New York to Chicago and return, carried hundreds of passengers at different cities en route, and without a single mishap.

It seems to me that performances of this kind prove that safe flying has arrived.

The Santa Maria on its arrival at Key West was given an overhauling and will soon be in daily service again between Key West and Havana.

We are frequently asked why we use flying boats exclusively instead of land planes. The answer is:

First. There is a large percentage of the public who would not go up in a land plane, but who will take a flight in a flying boat because they feel that a safe landing place is always available. The result is, the cost of procuring passengers is not so great as with the land planes.

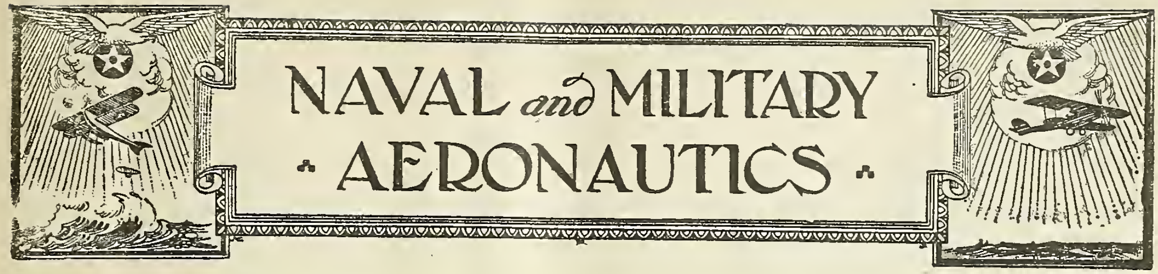
Second. Many of these people would not think of traveling at the high altitude considered safe for flying over land, whereas flying ten or fifteen or one hundred feet above the water does not seem to worry them.

Third. With flying boats we eliminate the necessity of expensive landing fields, often located at remote parts of the city. Our landing fields are Uncle Sam's rivers, harbors and lakes, and as the business center of every port is near the water front, our anchorage is always convenient to the hotels and to the center of business activity.

Fourth. For the above reasons we believe that for some time to come flying boat operations will afford greater returns for the money and effort expended than in operating land machines.

The operating costs which I am about to give you are based on the operation of the converted Navy boat equipped with both single and double Liberty motors, and while there are no doubt other types of aircraft which show a lower fuel cost per passenger mile, that saving is insignificant when contrasted with the low initial cost and the *safety* of these Navy boats for passenger-carrying purposes.

(*Continued on page* 427)



NAVAL and MILITARY AERONAUTICS

Reorganization of the Office of the Chief of Air Service

Under the reorganization of the Office of the Chief of Air Service, approved by General Patrick on December 1, 1921, five divisions are provided, viz.: Personnel, Information, Training and War Plans, Supply and Engineering. The office of the Chief includes the Assistant Chief of Air Service and the Executive Office. Subordinate to the Executive Office are the Finance and Medical Sections, the Legal Advisor and the Director of Aircraft Production (Spruce Production Corporation). The Orders and Files Section is under the immediate supervision of the Chief Clerk.

The Personnel Division is composed of three sections—Officers, Enlisted and Civilian. The Information Division comprises the Library Section, Special Section and Reproduction Section. Five Sections comprise the Training and War Plans Division, viz.: Schools Section, Tactical Units Section, R. O. T. C., National Guard and Officers' Reserve Section, War Plans Section and Airways Section. The Supply Division embraces the Property-Requirements Section, the Procurement Section and the Material Disposal and Salvage Section. The Engineering Division, located at McCook Field, Dayton, Ohio, a technical representative of which is on duty in Washington, is composed of the Planning Section, Technical Section, Factory Section, Flying Section, Procurement Section, Supply Section, Patents Section and Military Section.

The following assignment of officers on duty in the office of the Chief of Air Service has been made:

Executive, Major Walter H. Frank; Assistant Executive, Major Hubert R. Harmon; Chief of Personnel Division, Major Rush B. Lincoln; Chief of Information Division, Major Horace M. Hickam; Chief of Training and War Plans Division, Lt.-Col. James E. Fechet; Chief of Supply Division, Lt.-Col. William E. Gillmore; Chief of Engineering Division, Major Thurman H. Bane; Chief of Finance Section and Budget Officer, Air Service, in Office of Executive, Major Jenner Y. Chisum; Chief of Medical Section in office of Executive, Colonel Albert E. Truby.

To duty in:

Personnel Division: Major J. W. Simons, Jr., 1st Lieut. George E. Hodge.

Information Division: Capt. David S. Seaton, 1st Lieut. Charles H. Mills.

Training and War Plans Division: Major Herbert A. Dargue, Major Walter G. Kilner, Major Percy E. Van Nostrand, Major Leo A. Walton, Major Oscar Westover, Major Barton K. Yount, Capt. Oliver S. Ferson, Capt. Burdette S. Wright, 1st Lieut. Robert J. Brown, Jr., 1st Lieut. Wm. E. Connolly and 1st Lieut. Horace S. Kenyon.

Supply Division: Lt. Col. Harry Graham, Major Roy M. Jones, Major George E. A. Reinburg, Major Walter R. Weaver, Capt. Frederick F. Christine, Capt. Aubrey I. Eagle, 1st Lieuts. Wm. V. Andrews, Charles G. Brenneman, Edwin F. Carey, Aaron E. Jones, Benjamin R. Morton, and Edwin R. Page.

As Engineering Representatives: Major Henry W. Harms and 1st Lieut. Ernest E. Harmon.

Office, Assistant Chief of Air Service: 1st Lieut. Clayton L. Bissell.

Finance Section: Captain William F. Volandt.

Medical Section: Major Benjamin B. Warriner and Captain William J. Freebourn.

General Bandholtz Inspects Bolling Field

On December 7th Brigadier General Bandholtz, Commanding General of the newly formed District of Washington, inspected Bolling Field and its personnel. His expressed desire of having the soldiers at this station, in their appearance and drill, compare with the standard maintained at other Army stations in this District, is being rapidly fulfilled. New Melton cloth, well-fitting uniforms, are to be issued to all soldiers, and they are filled with the determination to show that the Air Service cannot be outdone in any military duty required of it.

This inspection was followed on December 10th by another by Major General Patrick, Chief of Air Service, whose talk afterwards was an encouragement and inspiration for better things in the future.

National Guard Aero Squadron Organized

The 137th Observation Squadron, Air Service, Indiana National Guard, was granted Federal recognition on August 1, 1921, and has to date received most of its equipment. Two large steel Government hangars, size 66 x 120, have been received. Ships are being set up at Wilbur Wright Field at the present time and will be flown to Kokomo, Indiana, the location of this squadron, very shortly. The minimum strength of the squadron is 24 officers and 90 enlisted men, and the maximum strength 132 enlisted men and 31 officers.

Navy Abandons Plans for Joint Manoeuvres

Washington.—The annual joint manoeuvres of the Atlantic and Pacific fleets, which were to be held in Panama Bay in February and March, 1922, have been abandoned, the Navy Department announced. The decision was reached by the department, it was stated, in the interests of economy and because of the shortage of funds available for purchase of required fuel.

Independent drills will be held by a number of warships of the Atlantic fleet, beginning January 3, in Guantanamo Bay, and drills and target practice will be conducted off the California coast by the Pacific fleet, the Navy Department announced.

A Loss to Naval Aviation

Naval Air Current, the service publication published at San Diego, Cal., announces in its issue of December 15 that, in compliance with an order from the Bureau of Navigation, it ceases publication with this issue.

This is to be greatly regretted, because it has been one of the best edited service publications, and has wielded a substantial influence for the good of naval aeronautics.

New Navy Laboratory

Work is progressing satisfactorily on the construction of the naval experimental and research laboratory at Bellvue, near Washington. The laboratory buildings are substantially completed and ready to receive their equipment. The present appropriations will provide for the cost of equipping and fitting the buildings, and will not cover the expenses of maintenance of the establishment in commission, consequently it will be necessary for the department to ask for subsequent appropriations before the laboratory is commissioned as a naval station. Captain E. L. Bennett, who has been selected as the director of the laboratory, has been detached from command of the U. S. S. New York and will report at the department about January 1 as the relief of Rear Admiral Wm. Strother Smith, U. S. N., who has developed the laboratory from its inception. Rear Admiral Smith has already reached the age of retirement and will be detached when Captain Bennett reports.

Airship Training at Ross Field

The course in Primary Airship Training for the class of officers stationed at Ross Field was started Monday, November 14, 1921, and the class is now deep in the intricacies of Navigation and Aerostatics. The work is proving very interesting and it is planned to make this department one of the strongest at the field. A motor room, where the actual tearing down and building up of aerial motors can be undertaken, is now being built and, in many other ways, the course in airship training will be made as interesting and instructive as possible. Very satisfactory progress has been made on the construction of two new steel hangars at this field. The grading and foundation work has been practically completed, and with the arrival of the steel the work will be pushed to rapid completion. Two airships, Types "C" and "D", are being shipped to Ross Field, and the arrival of these ships is eagerly awaited by the personnel, everyone being extremely anxious for an opportunity to ride in them.

Free Balloon Flight

A free ballon left McCook Field about 9:40 a. m., November 29th, and soared off to the northeastward before a brisk wind. The flight was made principally for the purpose of testing out a number of new instruments just received, and which includes a new statiscope, a barograph and a verimeter. Those who took the trip are Major Napier, Captain McFarland, Lieut. Schneeberger, Art Smith and W. E. Huffman.

FOREIGN NEWS

Aviation Lines in Brazil

A committee of the Brazilian Senate has reported favorably, according to the United States Naval Attache in Rio Janeiro, upon a bill proposing the establishment of two aviation lines between Rio de Janeiro and Porto Alegre, which are to be started before September, 1922. One of the routes will be laid out along the coast, carried out by hydroplanes, and maintained and directed by the Ministry of Marine; the other will traverse the interior of the country to the west of the coast range of mountains, and will be carried out by aeroplanes under the direction of the Ministry of War. The routes will pass through the most important political, industrial, and commercial centers wherever possible.

Aviation Rights in Chile

The Government of Chile has under consideration a 15-year exclusive concession for commercial aviation rights. Information has been received by the Department of Commerce from Rollo S. Smith, secretary in the office of the Commercial Attache at Santiago, to the effect that a petition from the local representative of the Spad and Bleriot aeroplane factories has been submitted to the Chilean Government, seeking a 20-year exclusive franchise to install and operate an aerial service between Iquique, Concepcion, and intermediate cities. The tariffs to be put in force, if the franchise is granted, will be submitted to the Government for its approval, and the landing stations will be at the disposition of military aviators. An advantatge claimed for the proposed service is that the trip from Santiago, the capital, to Antofagasta—a distance of 1,552 kilometers by rail and requiring a two days' journey—could be accomplished by aeroplane in something over five hours and at a cost per passenger of 500 pesos for the round trip.

Amsterdam Service Suspends

The aerial service between London and Amsterdam will be temporarily suspended for the winter months, according to the London *Times*. This service, which is run by a Dutch company known by the initials of K. L. M., and using Fokker machines, began operations in April. Since then the company's aircraft have made 352 flights between London and Amsterdam. In April next year the company intends to reopen the route with one service each way daily, which will be increased to two services a day on May 1st. The subsidy of Fl. 200,000 (about £17,500) granted to the K. L. M. by the Dutch Government for the years 1920 and 1921, which was intended to meet two-thirds of the company's estimated losses, has proved to be insufficient, and an increase of subsidy, amounting to Fl. 260,000 (about £22,800) has been applied for. The total estimate for civil aviation included in the Dutch Budget of 1922 amounts to Fl. 1,315,000 (about £115,000), of which Fl. 370,000 is asked to cover two-thirds of the company's estimated losses in the coming year. During five months this year the K. L. M. service carried 410 passengers between London and Amsterdam and, besides mails, nearly 18,000 tons of goods, nearly all British exports.

New English Company

According to the London *Financial Times*, an aviation company is to be formed to establish a route between Ostend, Brussels and London, having secured a substantial government subsidy for this purpose. The organization is practically complete, and includes as manager a man who is the prime mover in aerial navigation and has organized practically all the previously existing air services in England. It is intended to maintain a special daily service between Ostend and London throughout next summer.

Berlin Journal Asserts France Plans Air Attack on Germany

France is concentrating air forces in Alsace-Lorraine to secure domination of aerial navigation above the Continent, according to a Dutch officer writing anonymously in the *Lokal-Anzeiger*.

The writer contends that Southern Germany is already under control of the French from the air, as day and night bombing squads are being developed. The *Anzeiger*, a powerful Nationalist organ, tries to prove that France is preparing to attack Germany, but it gives the actual number of French planes in commission as 1,500, which is less than Premier Briand recently stated.

The officer's article says an air division with headquarters at Metz is preparing only for an attack against Germany. There is, he adds, a flying assault squadron at Thionville and Strasburg, supported by day and night bombing brigades, with their base at Nancy and the surrounding regions.

As France is now foremost in developing war planes and is taking advantage more than any other nation of progress in aviation, the writer holds this flying base places France in a position to control the air beyond her frontiers.

M. Michelin Retires

Owing to the state of his health, M. Michelin has felt compelled to resign the Presidentship of the Aero Club of France. M. Michelin has been a valuable asset to aviation from the earliest days, and his resignation must prove a severe loss to the French Club.

Germany and War 'Planes

From Berlin the figures given for aircraft destroyed, etc., up to October 1 last are 127,471 aeroplanes and 20,364 aero engines destroyed and 629 aeroplanes and 3,632 aero engines surrendered.

Gordon-Bennett Balloon Race

It has been decided—until such times as they may alter their views—by the Aero Club of Geneva, that the 1922 Gordon-Bennett Balloon Race is to be held on September 2, and start from Geneva. Zurich in this connection proposes to organize an aviation meeting.

British Air Ministry to Offer £50,000 For a Practical Helicopter Aeroplane

Subject to Treasury sanction, the British Air Ministry proposes to offer a prize of £50,000 for a practical helicopter-designed aeroplane; that is, an aeroplane capable of rising vertically over a given spot.

Following are among the conditions to be observed by the competing designers: The machines must be capable of rising to a height of 2,000 feet under their own power, carrying one man and one hour's fuel supply; able to remain stationary over a ground object for half an hour in any wind up to twenty miles an hour; able to land safely in any wind up to twenty miles an hour without horizontal motion and with the engine cut off; able to maintain a horizontal flight at a height of 2,000 feet at a speed of not less than sixty miles an hour.

Foreign as well as British inventors will be invited to take part in the competition.

Some months ago, it is stated, experiments with the helicopter were to take place at Farnborough with a British inventor's machine. Great secrecy was observed by the Air Ministry in regard to the tests.

According to reports received in London last April, a successful flight with a helicopter had been made abroad. This machine was invented by Lieutenant von Petroczy of the Austrian Army Balloon Corps.

Baby Takes Air Trip

The world's youngest aeroplane passenger is believed to be Christian Martin, the 17 months old son of Louis Martin, a French pilot.

Against the advice of a doctor, Christian was strapped in the seat of an aeroplane beside his father and flew for half an hour over Strasbourg without experiencing any ill effects.

Airmen to Be Guided on Cloud Distances

Among the many important developments being tested here for the proposed scientific illumination for night flying, airmen on the London-Paris route is a method of finding the height of clouds.

The apparatus consists of a powerful searchlight for throwing vertical beams on clouds and an especially designed theodolite, through which to observe the clouds. The searchlight is placed at the measured distance from the theodolite, which consists of a telescope mounted in such a way that the angle at which it is pointed can be read with minute accuracy on a special scale. It is set so that the point where the beam enters a cloud can be seen through the center of the telescope of the theodolite, with the result that it is easy to calculate the height of the cloud from a known angle.

It is proposed to establish this apparatus at stations along the airway so as to inform pilots of cloud distances by wireless.

Air Taxi Flies 2,000 Miles to Deliver Christmas Gift

Alan J. Cobham, well known "air taxi" pilot, has successfully traveled 2,000 miles by air in order to deliver a Christmas parcel in London. He is touring Europe and Northern Africa on a 10,000 mile journey with Lucian Sharpe of Providence, R. I., a wealthy retired American business man. They arrived in Barcelona on December 22, when his "fare" announced he desired to pass Christmas in Madrid, but wanted a parcel delivered in London before Christmas Day.

Cobham left Barcelona Friday morning before Christmas and made a nonstop flight to Dijon. Saturday he flew from Dijon to London without stopping. After delivering the parcel he went to Bristol and passed Christmas Day with friends there. He started his two day return trip to Spain on Tuesday.

Flying a De Haviland "nine," Mr. Cobham is the most successful "air taxi" pilot in the world. He travels "light," without a mechanic. He has flown over practically all the European countries in 1921 and says that in that period he covered more than 20,000 miles. He did not have a single serious accident.

A Modern School Seaplane

The need of a school seaplane really modern in design and construction was felt very much by the Italian and foreign hydroaviation, a seaplane that could answer to all requirements that several land aircraft already had, and to this need the Societa Idrovolanti Alta Italia of Sesto Calende has supplied a new "Savoia" seaplane: the S-23.

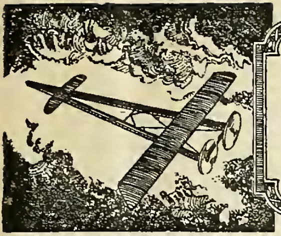
The constructors have not only conferred to such aircraft all the experience acquired in the construction of the many types of Savoia machines, but also the old experience gained while running the seaplane training school, instituted by the S. I. A. I. ever since 1915, near by her flying station of S. Anna on Lake Maggiore; this was the first school for pilots of seaplanes founded in Italy, which in a short time began to give a pilot a day, without the least incident, and it will soon be reopened as a training school for civil aviation pilots of seaplanes.

The S-23 is equipped with the economical engine I. F. V4B, the boat is very solidly built with ply wood and one ply birch inside; the duel control is very solid and docile; the equipment of board, handles, etc., have had the most proper and well suited arrangement for pilots' instruction.

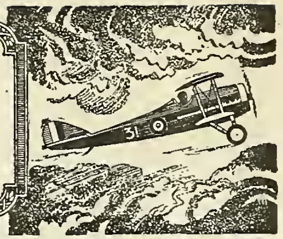
Particular care is taken in order to obtain the easiest way of repairs. The machine is generous of stability.

Beside the training of pilots the S-23 can also be employed for services where great speed is not required, for, between the limited power of the engine, the high aerodynamical rendition of the machine, and the economical speed assigned to it (150 Km. p.h.) this very modern Savoia seaplane offers the greatest running economy together with the other good qualities of other Savoia seaplanes.

The following are the characteristics of the S-23: Engine, Isotta Fraschini type V4B, h. p. 160. Best speed about Km. p. h., 150. Landing speed about Km. p. h., 75. Endurance, hours, 2. Weight empty, Kg., 1160. Useful load, Kg., 240. Carring area, square m., 43.39. Maximum wing span, square m., 12.44. Overall length, square m., 10.00. Maximum height, square m., 3.23. Safe factor over, 6.5.



ELEMENTARY AERONAUTICS *and* MODEL NOTES



Aerodynamic Tests on an Alsatian Swift

(From a paper read before the L. I. Flight Association)

IN connection with the problems on motorless flight, the aerodynamic properties of our soaring and gliding birds are of especial interest. The following excerpts are from the British Aeronautical Research Committee Test No. 708.

The test was made on an Alsatian Swift. The purpose of the test, primarily, was not to investigate its soaring possibilities, but to compare an efficient bird form with present aircraft forms. However, the results are of especial interest to us, since it tends to disturb one of the most favored of our theories on soaring and gliding.

From time to time, designers come forward with the contention that a radical departure from the stereotyped form of modern aeroplane would be a big advance in aeronautical design. They urge the adoption of an outline similar to that of a bird, referring to birds capable of undertaking extended glides, and contend that these have naturally developed an aerodynamically efficient form which enables them to glide with advantage. The soaring flight of other birds is also instanced as indicating the relatively small expenditure of energy required during flight; and although the mechanism by which this form of locomotion is achieved is still obscure it is claimed that an aeroplane designed to embody the essential features of bird form should prove highly efficient.

The acceptance of this contention is somewhat hindered by the results of the tests following. These show the maximum lift coefficient to be .0026, and the best gliding angle to be 4.55 to 1, corresponding to a maximum lift drift ratio of 4.55. These measurements, of course, refer to the bird with the wings fully distended and maintained in a position which was thought to be suitable for gliding flight; it is possible, therefore, that they represent a low estimate of the performance, which may be exceeded in actual flight owing to the effective alteration of the wing section by muscular means. However, as representative of a particular form of construction, they suggest that no particular advantage is to be gained in practice by use of wings of a similar outline.

Details of the Swift are given in Fig. 1. A noticeable feature of the bird is the large size of body, in comparison with the wing area.

The results obtained at wind velocities of 13.6 and 27.2 m.p.h. are given in the appended table below. It should be noted that the wings were allowed to deform under the wind forces at the lower velocity, but were fixed in relation to the body at the high velocity by means of a fine wire.

Table of Values Obtained at 13.6 m.p.h. and 27 m.p.h. Velocity

Incidence Angle (degrees)	Wind Speed 15.6 m.p.h.			Wind Speed 27.2 m.p.h.		
	Ky	Kx	L/D	Ky	Kx	L/D
0	—.00018	.00023	— .77	.00032	.00027	1.18
2	.00022	.00024	+ .9	00055	.00027	2.56
4	.00058	.000255	2.28	.00078	.00028	2.8
6	.00091	.00028	3.25	.001	.00030	3.38
8	.00124	.00031	3.98	.00128	.00032	3.95
10	.00156	.00035	4.49	.00152	.00036	4.3
12	.00189	.00042	4.5	.00173	.00041	4.35
14	.00214	.00048	4.55	.00199	.00044	4.54
16	.00232	.00056	4.1	....	....	....
18	.00237	.00066	3.58	.00231	.00055	4.15
20	.00244	.00080	3.03	....	....	....
22	.00254	.00093	2.74	.00250	.00072	3.44
24	.00254	.00102	2.49	....	....	....
26	.00253	.00116	2.18	....	....	....
30	.00262	.00142	1.84	....	....	....
35	.00262	.00169	1.55	....	....	....
40	.00255	.00197	1.29	....	....	....

In conclusion, it is thought that while the above experiments will be found highly interesting to those interested in soaring flight, further experiments with larger birds, as the gull, buzzard, etc., will provide far more comprehensive data on the subject.

Norwegian Aero Model Club

Nearly a year ago, a group of flyers, engineers and others interested in aeronautics in Christiania, Norway, formed a club called the "Norsk Aeromodel Klub" or the "Norwegian Aero Model Club."

The club has an insignia which can be worn only after a member is proficient enough in model building to gain at least 575 points or merit marks, according to the rules arranged for the purpose of awarding such marks. The insignia is a garland wreath tied with a bow of ribbon at the bottom and with a small shield at the top; in the shield are the initials "N. A. K." and at the center of the wreath is a soaring bird with wings outstretched beyond the wreath.

A competition for the awarding of merit marks was held last October 9th. A model constructed by Mr. Harald Gulbrandsen, member of the management of the club, gained 936 points. The model flew 103 metres. The secretary of the club, Mr. Henry Stub, has the best model, the "H-723," which flew a distance of 170.57 metres.

The members of this club are anxious to hear from the various clubs and others interested in models in the United States.

A Compressed Air Driven S.E.V. Scale Model

Among the many scale models built in the last five years by Mr. Richard Sanchez of 1572 73rd Street, Brooklyn, N. Y., are JN-4s, de Havilland 4s, Christmas Bullet, Nieuports, Spad, Curtiss flying boat, Sopwith, Bleriots, Taubes, Albatross and an S.E.V. The S.E.V. was built from the plans published in *Aerial Age* but differs from the plans in the matter of power, for the Sanchez model is driven with a compressed air engine. Mr. Sanchez has, moreover, carried out extensive experiments with compressed air engines and has, at present, three rotaries and two 2-cylinder opposed engines as well as three air tanks.

The specifications of the S.E.V. model are as follows:

Specifications

Span	42 inches
Chord	8¼ inches
Propeller	16 inches
Engine	2 cyl. opposed, ¾-inch, ¾-inch bore and stroke
Pressure	150 pounds
Distance of flight	150 ft. R.O.G.
Weight	28 ounces

Fuselage

The longerons are of 3-16" spruce. The tank is tapered. This enables it to be incorporated very neatly in the fuselage. The motor is mounted directly in front. The fuselage covering is of aluminum and veneering. A cockpit and wind shield are furnished. The whole fuselage is given a coat of grey paint and three coats of varnish. A dummy Hispano-Suiza motor of balsa wood is installed.

Wings

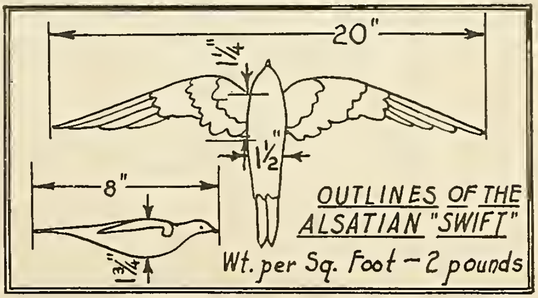
The wings are of orthodox construction. They are painted grey and varnished.

Engine

The motor is a two-cylinder opposed type. It swings a sixteen inch propeller at a rate of 2,000 R.P.M. The tank is equipped with a filling valve, a control valve, and a safety valve which can be adjusted to a pressure of 150 lbs. The whole compressed-air equipment was manufactured by the Model Machine Shop of 415 East 71st Street, New York City.

General

The entire machine is painted a service grey and has the official U. S. Army insignia on the wings and rudder.



OUTLINES OF THE ALSATIAN "SWIFT"
Wt. per Sq. Foot — 2 pounds

A-E-R-O-N-I-T-I-S

Roving the Sky

By L. L. De Jean

Oh, come with me, and let us flee
From folks down here below;
Once in my plane, we soon will gain
Where no one else can go.

We first will chase, and then will race
The eagle in his flight;
Thro' heaven's realm I'll lift our helm
Until we're miles in height.

Up there I'm king, and we will sing
For joy that we are free;
And we'll look down on field and town;
We'll fly o'er land and sea.

Once there, we'll reign o'er our domain
More absolute than Jove
In ancient times, 'mid Grecian climes,
When great Olympus throve.

Let's go away this very day,
If only for an hour,
And skyward stray, thro' cloudy spray,
To heaven's sunny bower.

Let's go and try to verify
The tale of rainbow's end;
A pot of gold we may behold,
We'll bring it home to spend.

Or, better yet, we'll just forget
The way back to this earth;
A call we'll pay the Milky Way,
And there we'll seek a berth.

We'll roam afar until a star
Invites us to remain
And be his guest the while we rest;
Then on we'll rove again.

This world's too small; I've seen it all,
And now I want to go
To see some more, and to explore
The worlds we do not know.

We Are Unusual Men

Nothing to spend but cash,
Nothing to eat but chow;
Chicken, turnovers and hash,
Spuds and fricasseed cow.

Nowhere to go but out,
Nowhere to stay but in—
It's awful beyond a doubt
And I am growing thin.

Nothing to see but shows
Over and over again;
But we all get tired of those
For we are unusual men.

Nothing but words to say,
Nothing to hear but sound;
Same thing, day after day
Until your bean goes round.

We work and we eat and we sleep,
And line up to draw our yen;
We don't get a deuce of a heap
But—we are unusual men.

Shortest Poems

Saw a queen
Limousine;
Didn't look
Good book
Taps.

Another

Night,
Fight;
Blows,
Nose;
Gore,
Roar;
Cop:
"Stop!"
Talk,
Walk;
Cell,
"H——l!"

"Another One"

Please don't judge us by tradition,
Rather by the flag we serve;
We'll make up for lack of culture
When the needed thing is nerve.
And I know they'd be more happy
If my shipmates knew that they
Carried with them the well wishes
Of the whole darn U. S. A.
—*Nick Kenny, U. S. S. Arizona.*

Home Brewtality

A local man tried some of his homebrew on the cat the other night and the animal rose up and whipped a 12-inch electric fan in one round.—*Eldorado Times.*

Two on a sofa
Shoulder to shoulder
Algy becoming
Just a bit bolder
Closer and closer
Hearts madly beating
Smack goes a—lock
Enter, Dad from the meeting

A man I know kicked up a row,
That stirred the neighbor's wrath.
He walked up to a lady cow,
And slyly pinched her calf.—*Gargoyle.*

You may be the world to your mother, but you give me a pain in the neck.

A pretty face is like a melody, but we would all like to sing it in A flat.

A good piano player will always give you a good run for your money.

Little Proverbs

A fool and his honey are soon parted.
All is not pups that litters.
A rolling stone knows no boss.
Still whiskey ruins sleep.
When papa comes in at the door, love flies out the window.

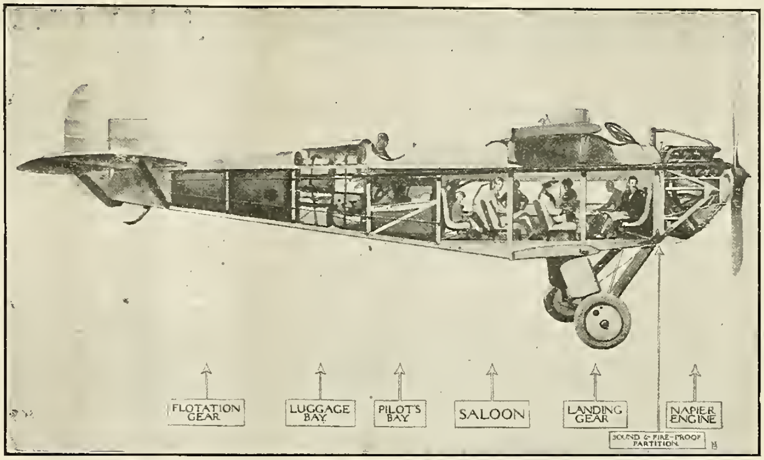
Mary wore a little skirt
Indeed that swept the walks,
She did not camouflage her face
Nor did she roll her sox.
And yet the men in Mary's town
Classed her among the chiques,
For Mary wore that little skirt
In eighteen-ninety-six.

Serenade

My whole month's salary went
To buy my wife a hat;
We had an argument—
I used a baseball bat.
She sleeps,
My lady sleeps,
Sleeps.

THE

DH18



The machine which can transport 8 passengers at a gross cost of **8 cents** each per mile.

IMPORTANT:—By GROSS COST is meant fuel, pilot, insurance, maintenance and depreciation of machine and engine, all overhead charges, and every expense involved in running an air line.

AMERADA ENGINEERING CORP. 505 FIFTH AVENUE NEW YORK CITY

(*Continued from page* 422)

The following figures include everything but administrative overhead and advertising. Those items are not included, because in our case we have spent thousands of dollars in national publicity endeavoring to call to the public's attention the possibilities of aviation. These boats have been used to a large extent in that work—in fact, the expense of a trip from Key West up the coast to New York and around the Great Lakes and down the Mississippi is all included in our administrative overhead and advertising, and should not be a part of any commercial aviation company's expense, doing strictly a passenger and freight carrying business.

Therefore our figures show the actual operating costs and the possible profits, operating to capacity four hours per day:

Cost of Operating an HS2L Six-Passenger Aeromarine Navy Flying Boat With Liberty Motor

45 weeks per year
4 flying hours per day
5 days per week
Valuation, $7,500
Life of motor, 800 hours
Life of boat, 3 years
Insurance, 32%

Interest, 7%
Gasoline consumption for Liberty motor, cruising speed, 27 gals. per hour
Oil consumption, cruising speed, 1½ gals. per hour

Oil	$0.80 per gallon
Gasoline	$0.25 per gallon
Pilot	$75.00 per week
Mechanic	$45.00 per week
Bowman	$30.00 per week

Cost per flying hour, including pilot, mechanic, fuel, maintenance, depreciation, insurance and interest....$29.98

INCOME

Figuring 5 *passengers* per load at $10.00 per passenger	$ 50.00	
4 flights of 10 minutes each	200.00	per hour
4 hours per day	800.00	per day
5 days per week—20 flying hours	4,000.00	per week

TOTAL INCOME

Figuring 5 passengers per load	4,000.00	per week
Total cost	599.72	

This allows liberally for administrative expense, advertising and dividends $3,400.28

Cost of Operating an F5L Eleven-Passenger Aeromarine Navy Flying Cruiser With Twin Liberty Motors

45 weeks per year
4 flying hours per day
5 days per week
Valuation, $30,000
Life of motors, 800 hours each
Life of boat, 3 years
Insurance, 32%

Interest, 7%
Gasoline consumption for Liberty motor, cruising speed, 27 gals. per hour
Oil consumption, cruising speed, 1½ gals. per hour

Oil	$0.80 per gallon
Gasoline	$0.25 per gallon
Pilot	$75.00 per week
Mechanic	$45.00 per week
Bowman	$30.00 per week

Cost per flying hour, including pilot, mechanic and Bowman, fuel, maintenance, depreciation, insurance and interest $71.12

INCOME

Based on prevailing charges—either $40.00 per flying hour or $10.00 per 10-minute sightseeing flight.

Figuring 9 passengers per load at $10.00 per passenger for 10-minute flights	$ 90.00	
4 flights of 10 minutes each	360.00	per hour
4 hours per day	1,440.00	per day
5 days per week—20 flying hours	7,200.00	per week
Figuring 5 passengers per load at $10.00 per passenger for 10-minute flight	50.00	
4 flights of 10 minutes each	200.00	per hour
4 hours per day	800.00	per day
5 days per week—20 flying hours	4,000.00	per week

TOTAL INCOME

Figuring 9 passengers per load	7,200.00
Total cost	1,420.00
Balance	$5,779.42

TOTAL INCOME

Figuring 5 passengers per load	4,000.00
Total cost	1,420.00
Balance	$2,580.00

These balances allow liberally for administrative expense, advertising and dividends.

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JAMES LEVY 2055 Indiana Ave. Chicago, Ill.
DE LUXE AIR SERVICE Asbury Park, N. J.

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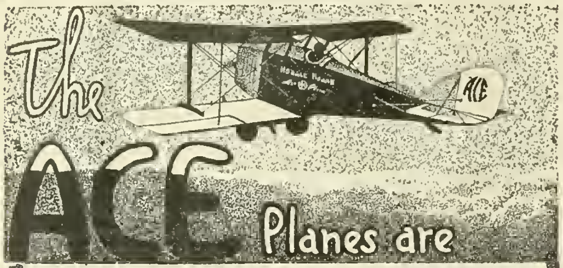

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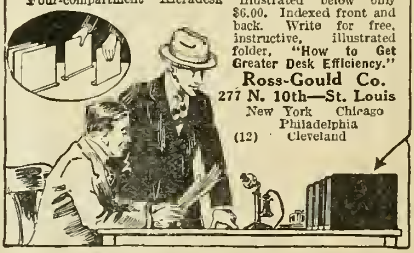

IN order to make room to start manufacturing our three place $2500.00 American product of high efficiency and economy airplane we offer new linen and cotton covered Canuck wing panels at $100.00 each. New rudders, new elevators, new ailerons, each $16.00. OX5 motor parts 50% off. New propellers—each $17.50, OX5.

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1 Set (4) wing covers (cotton) with tape and dope....	$69.00
2 Upper wing covers (cotton) with tape and dope....	45.00
2 Lower wing covers (cotton or linen) with tape and dope	38.00

Single covers Upper $15.00 Lower $14.00
Acetate dope per gal. $1.00
Other material and parts at correspondingly low prices

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Grade A Cotton 40c per yard.
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Pacific Bldg., Washington, D. C.

SACRIFICE—New OXX2 100 H.P. motor, $400.00. Hub and regular equipment complete. Must have cash. This is a bargain. Motor parts sacrificed, very few on hand. V. E. Treat, Belmar, N. J., RFD 1, Box 73.

STANDARD J1 NEW complete original crates. Will sacrifice for $625.00. Special freight arrangement. You gain deposit already paid. Write Box 642, c/o Aerial Age Weekly, 280 Madison Ave., New York City.

NEW STANDARD AIRPLANE without motor $800 F. O. B. Houston. Floyd Logan, 712 W. Superior Ave., Cleveland, Ohio.

THOMAS-MORSE SCOUT, latest model, instruments complete. Original crate. Price $350.00. New motor same $100.00. Fine stunt ship. Marvin Northrop, Minneapolis Athletic Club, Minneapolis, Minn.

WANTED—We buy and rebuild airplane crashes. Try us for prompt, accurate and satisfactory work. The Lowell Aircraft Co., Oherlin, Ohio.

COMPLETE NEW SET J1 Standard wings wires struts cables never uncrated. Outfit for less than $200.00. Cheaper than recovering. Write Box 643, c/o Aerial Age Weekly, 280 Madison Ave., New York City.

WILL PAY $2000.00 cash for two Canucks or American D's. D. W. Miller, Milledgeville, Ill.

SUPPLIES—Canuck and Jenny, OX5, new covered wings, upper $85.00, lower $80.00. Perfect condition. New dope $1.70 gal., 5 gal. lots $1.60 gal. Spar varnish $3.20 gal. Spark plugs 40c. If I haven't got what you want can get it at big saving. North Central Aviation Co., R. W. Shrock, Mgr., Marceline, Mo.

EXTRA — EXTRA — This week only — New Canuck slightly used, motor turns 1500. Bargain $1000. Also one double aileron JN4D, motor turns 1400. Special $800. Both these ships guaranteed and ready to fly. Winter price list now ready. Robertson Aircraft Corporation, 5248 Oakland Ave., St. Louis, Mo.

CANUCK BLUEPRINTS—$1.50 each—showing wing assembly, wires, etc., OXX2 motor, new, $400 knock-down Canucks. DeLuxe Air Service, Inc., Asbury Park, N. J.

ANYBODY INTERESTED IN PLANS of aeroplane to do over 300 miles per hour write to A. Hays, Box 1447, Casper, Wyo.

FOR SALE—New Liberty motor parts, reasonable price, immediate shipment. Also brand new Curtiss OX5 cylinders. Never uncrated. Address Grant Motor Co., 912 E. Grand Blvd., Detroit, Mich.

OFFER $50.00 for Curtiss OX5 motors complete, used, wrecked or burned. Not for flying. State condition carefully. Address Box 638, c/o Aerial Age Weekly, 280 Madison Ave., New York City.

K-6 ORIOLE, OX5 STANDARD AND JN4D, all in first class condition, for sale at sacrifice. 613 North Marsalis Ave., Dallas, Tex.

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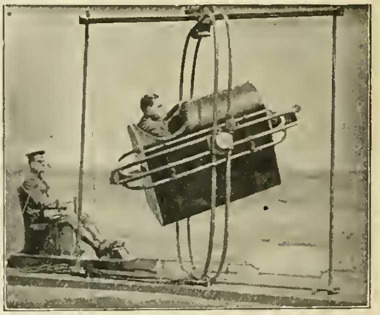

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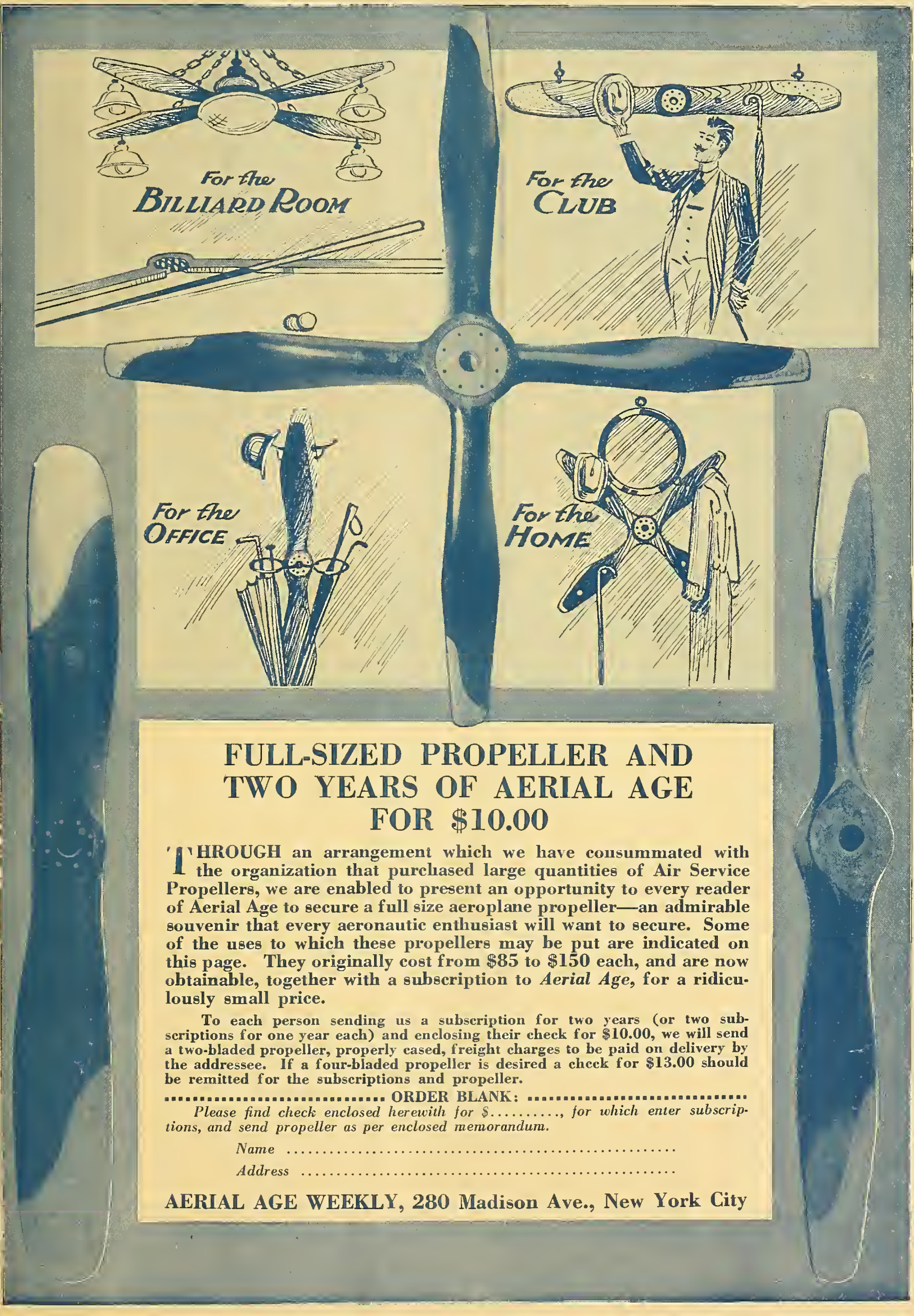

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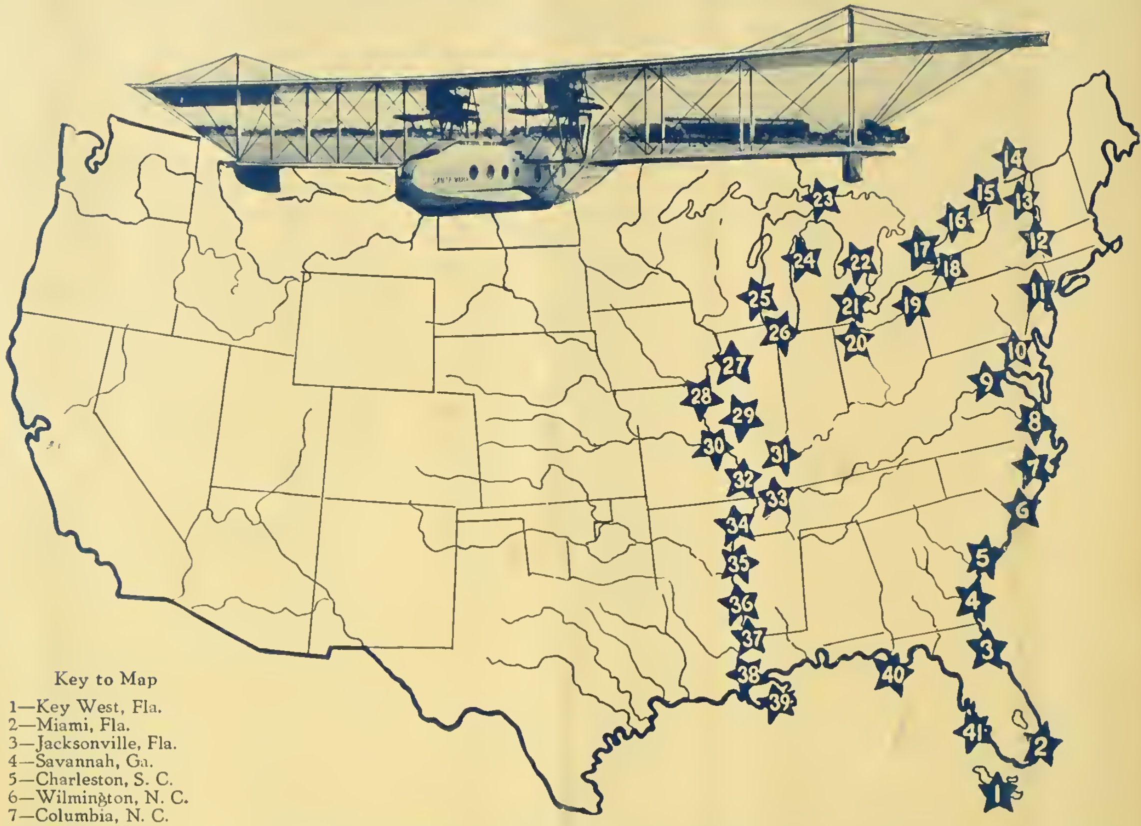

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2—Miami, Fla.
3—Jacksonville, Fla.
4—Savannah, Ga.
5—Charleston, S. C.
6—Wilmington, N. C.
7—Columbia, N. C.
8—Norfolk, Va.
9—Washington, D. C.
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12—Albany, N. Y.
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The Aeroplane Speaks

By H. Barber, A. F. Ae. S. (Captain, Royal Flying Corps). Postpaid $3.25.

Captain Barber, whose experience in designing, building and flying aeroplanes extends over a period of eight years, has written this book to be of assistance to the pilot and his aids. Lucid and well illustrated chapters on flight, stability and control, rigging, propellers and maintenance are followed by a glossary of aeronautical terms and thirty-five plates illustrating the various types of aeroplanes and their development from the first practical flying machine. An introduction presents, in the form of conversations between the various parts of the aeroplane, a simple explanation of the principles of flight, written, says the author, "to help the ordinary man to understand the aeroplane and the joys and troubles of its pilot." [McBride.]

Aeroplane Design

By F. S. Barnwell. With a Simple Explanation of Inherent Stability—By W. H. Sayers. With diagrams. Postpaid $1.10.

Mr. Barnwell, who is well known as a highly successful designer, holds a commission in the Royal Flying Corps. The section of this book written by him formed a treatise read before the Engineering Society of Glasgow University. Mr. W. H. Sayers in the second part of the volume elucidates a problem that has been the occasion of much discussion among mathematicians—that of inherent stability. Both sections are fully illustrated by diagrams. This book has been adopted by the U. S. Government as a text book for the instruction of aviators. [McBride.]

Aerobatics

By Horatio Barber, A. F. Ae. S. With 29 half-tone plates showing the principal evolutions. Postpaid $3.50.

This book by Captain Barber, whose earlier work, "The Aeroplane Speaks", is recognized as the standard textbook on ground work and the theory of flight, is an explanation in simple form, and for the benefit of the student, of the general rules governing elementary and advanced flying. Part I, which is headed "Elementary Flying", is an explanation of the essential elements of flight instruction from the moment the student enters the machine until he becomes a finished pilot. The mechanical control of the machine, straight flying, turns of all kinds, stalling, diving, gliding, slide-slips, and various ways of landing, flying through clouds, "taxying" and the first solo flight are described and analyzed fully and in non-technical language, each subject being taken up in progressive order. Part II explains the more advanced evolutions such as looping, spinning, the half roll, the complete roll, the Immelman turn, the falling leaf, the cart wheel, etc. The book contains a progressive syllabus of instruction, a glossary of technical terms and numerous advisory hints. [McBride.]

Flying Guide and Log Book

By Bruce Eytinge. With a Foreword by H. M. Hickam, Major, Air Service. 1921 edition, enlarged and revised to date. 150 pages. 4¾ by 7¼. 38 illustrations, including many photographs of landing fields, and a 24-page Pilot's Log Book for Machine, Motor and Flying. Cloth. Postpaid $2.75.

This book contains valuable information for the aviator, and also, for all those who are interested in, and helping to develop, commercial aviation. Contents.—Calendar. Identification. Frontispiece. Foreword. Past and Present (Poem). Introduction. Don'ts. Helpful Hints. Landing Field Report (Questionnaire). Airdromes—Landing Fields. War Department Orders: Specifications for Municipal Landing Fields. General Flying Rules to Be Observed At All U. S. Flying Fields. Cross-Country Flight Regulations. Rules of the Air. Flying Certificates for Pilots. Trouble Shooting in Airplane Engines. America's Aviation Facilities—Landing Fields (Alphabetically Listed Under Each State). Trans-Continental Aerial Mail Route. Air Routes (Round the Rim Flight). Pilot's Log Book for Machine, Motor and Flying. [Wiley.]

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AERIAL AGE WEEKLY **280 Madison Avenue, New York**

January 16, 1922

AERIAL AGE
WEEKLY

VOL. XIV, No. 19

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THE
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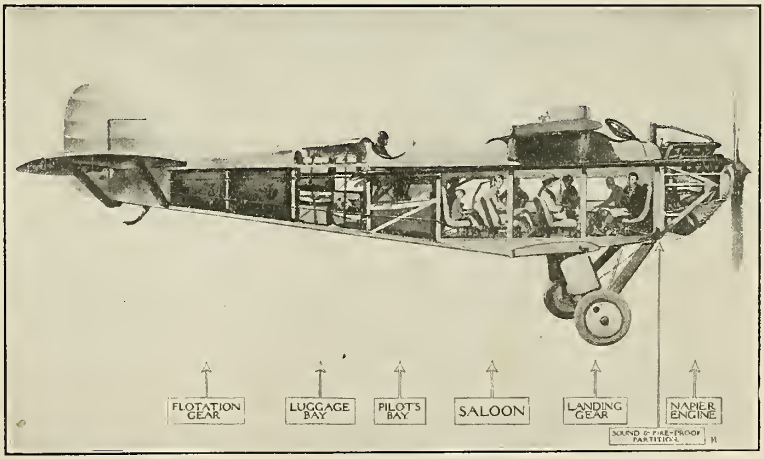

The machine which can transport 8 passengers at a gross cost of **8 cents** each per mile.

IMPORTANT:—By GROSS COST is meant fuel, pilot, insurance, maintenance and depreciation of machine and engine, all overhead charges, and every expense involved in running an air line.

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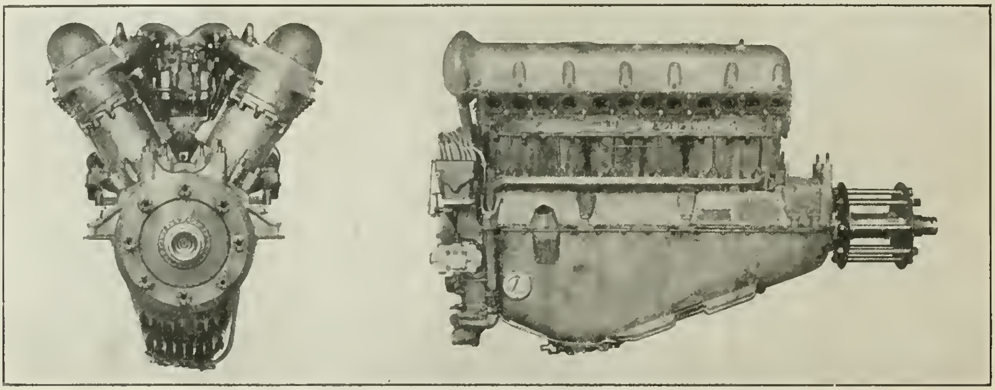
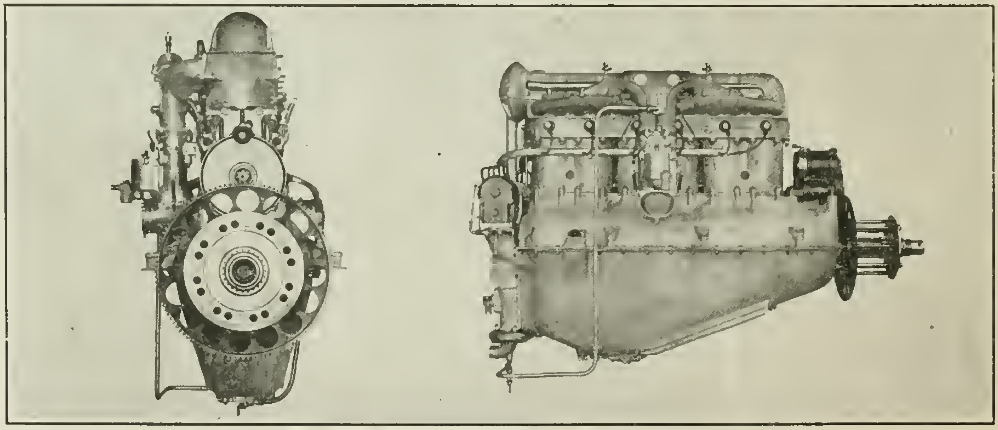
Curtiss



"CURTISS" MODEL CD-12 AVIATION ENGINE

Number of cylinders	12
Arrangement and angle of cylinders	60° vee
Water or air cooling	Water
Bore	4½ in.
Stroke	6 in.
Brake Horse Power	385
RPM of crankshaft above BHP	2000
Reduction gear ratio	Direct Drive
Gasoline per hour	32.1 gals.
Gasoline per BHP hour	.50 lbs.
Oil per BHP hour	.015 lbs.
Weight dry but complete	700 lbs.
Weight of jacket water	38 lbs.
Piston displacement	1145 cu. in.
Brake M.E.P. per sq. in.	135 lbs.
Compression ratio	5.7:1
INSTALLATION DIMENSIONS:	
Overall length	58⅛ in.
Overall height	37½ in.
Overall width	28¼ in.
Height above engine bed	21½ in.
Thickness of engine bed	1½ in.



"CURTISS" MODEL C-6-A AVIATION ENGINE

Number of cylinders	6
Arrangement and angle of cylinders	Vertical
Water or air cooling	Water
Bore	4½ in.
Stroke	6 in.
Brake Horse Power	160
RPM of crankshaft above BHP	1750
Reduction gear ratio	Direct Drive
Gasoline per hour	13 1/3 gals.
Gasoline per BHP hour	.50 lbs.
Oil per BHP hour	.015 lbs.
Weight dry but complete	420 lbs.
Weight of jacket water	19 lbs.
Piston displacement	572.5 cu. in.
Brake M.E.P. per sq. in.	128 lbs.
Compression ratio	5.2:1
INSTALLATION DIMENSIONS:	
Overall length	57 19/32 in.
Overall height	40¾ in.
Overall width	23 3/32 in.
Height above engine bed	24 11/32 in.
Thickness of engine bed	1½ in.

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THE NATIONAL
TECHNICAL, ENGINEERING AND TRADE
AUTHORITY

With which is consolidated

Flying

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The British Helicopter Prize

THE British Air Ministry's offer of a prize of £50,000 for a helicopter is detailed and specific. The machine must rise to a height of 2,000 feet under its own power, remain stationary for half an hour in light to strong winds, maintain a horizontal flight at a speed of sixty miles an hour, and land by vertical movement with the engine cut off. This is a recognition of the study now being made in many countries to design a practicable helicopter. The British Air Ministry must know in a general way what the inventors are doing. Its offer would not be made if the Hanschk helicopter had solved the problem. A dispatch from The Hague recently said: "The Hanschk helicopter makes 500 kilometers (312 miles) an hour, can ascend and descend vertically, remain stationary in the air, and cannot fall." The inventor has declared that he could fly it to New York in one day. He talks of winning the million-dollar prize for a flight around the world. If it is true that Colonel Williams, chief of the British Aviation Commission, examined a model of this helicopter in Berlin and believed it to be practicable, why is the British Air Ministry making an attractive offer for a machine that will do much less than is claimed for the child of Herr Hanschk's brain?

Designers have long been at work upon helicopter models. It must always be an ungainly looking machine, judging from pictures. The helicopter is expected to rise straight up and go straight down, as well as to fly horizontally at a greater speed than the aeroplane. Among the inventors who are supposed to have come near success are, besides Hanschk, Pescara, of Argentina, Petroczy, an Austrian, and the Frenchmen, Peugeot, Lacoin and Damblanc. The combination of the Greek words helix, a spiral or screw, and pteron, a wing, from which the name of the queer flying machine is made up, explains the task of the inventors. They must provide the machinery to operate screws and wings (planes) so that the car of the pilot may be lifted or lowered vertically and by a change of gear made to move horizontally. The device of the aeroplane propeller is simple by comparison. Petroczy's helicopter was lifted straight up with a crew of four men, and it hovered almost stationary. Afterward it came to grief. To raise it, two vertical propellers were concentrically arranged on a mast. Two masts are used on what is called the Oehmichen-Peugeot type. A motor of not very high power, as yet, is used on all the helicopters. The problem of lifting seems to have been solved; that of driving them horizontally is another matter. It has been said by enthusiasts that the helicopter will some day come into general use as the automobile of the air. Considering what has been accomplished with the aeroplane in eighteen years, who will venture to assert that the helicopter is the stuff that dreams are made of?—Editorial in *N. Y. Times.*

No Limitations for Aircraft

THE Conference on the Limitation of Armaments has unanimously adopted a resolution that "it is not at present practicable to impose any effective limitation upon the numbers or characteristics of aircraft, either commercial or military." Air craft include dirigibles, although the use of dirigibles in commerce is not now considered very seriously. It is true that the Germans talk of an Atlantic passenger service by lighter-than-air ships, but gales and electrical storms would probably make it hazardous at the present state of the art. As a war machine, however, the dirigible is considered to be indispensable. Carrying many tons of high explosives, it could be terribly destructive. Protection to the dirigible might be afforded by a fringe of aeroplanes. It is to be regretted that the conference placed aeroplanes and lighter-than-air ships on the same plane as regards limitation. Because dirigibles might be put to commercial uses, not because they were actually being employed extensively, there was to be no attempt to restrict them as war machines.

Now aeroplanes are being employed extensively to carry passengers, express and freight. In the United States, where aviation does not have as much encouragement as it receives in Great Britain and on the Continent, civilian flying increased 20 per cent. in 1921 as compared with the preceding year. About 1,200 aeroplanes, it is estimated, were operated in 1921, and, according to Captain E. V. Rickenbacker, who made the statement at the dinner of the Aero Club on Monday night, the number of miles flown was 6,500,000. Rear Admiral W. F. Fullam (retired) did not exaggerate when he said at the Aero Club dinner that if the United States had a properly equipped air force no enemy fleet could come within 200 miles of the coast. The Admiral believes—and he has plenty of company in the navy—that the bombing aeroplane has rendered the capital ship practically obsolete. Therefore a ten years' construction holiday is no great sacrifice for any sea power. The aim of every one will be to make preparations for war in the air and not be caught napping. There is a certain consolation, and room for hope that war may be made unattractive, in the proposal of another conference to regulate the use of aircraft in warfare.

THE NEWS OF THE WEEK

Conference Aircraft Experts Submit Their Report

Washington.—The final draft of the report of the arms conference sub-committee on aircraft was completed Dec. 31 and submitted for consideration by the conference. The discussions in the sub-committee are known to have brought out the feeling among the representatives of all five Powers that no impediment should be put in the way of commercial development of aircraft such as might result from an attempt to prevent creation of an air force in each country quickly convertible to war machines at need.

It has been contended by some experts that in fostering development of a new and swift means of communication and transportation the governments represented at the Washington Conference would be taking a very direct step toward lessening the probabilities of wars.

Scholars are said to be agreed that uneven distribution of natural resources among nations has been the underlying cause of most wars. Another war promoting factor, it has been held, has been misunderstandings between peoples due to lack of adequate communication facilities between countries.

In the probable development of air navigation may lie a cure for these fundamental and hitherto unavoidable seeds of war, it has been said. Through air transportation most experts expect to see wider access to natural resources of the world made possible and a consequent lessening in the struggle for actual physical control of those resources.

Effective Work by Airmen at Ottawa

Ottawa, Can.—Seaplanes and aeroplanes on the Ottawa (Rockcliffe) station spent over 85 hours' flight during two months' activity in the late summer and autumn this year, according to a report of the Air Board just compiled. Tests were carried out in the vicinity of the Capital with a gyroscopically controlled camera, as a result of which, improvements to the camera are now being made. A photographic survey of the Gatineau Valley was also made for the geodetic survey branch of the Interior Department. The airmen from the Ottawa station also did survey work along the St. Lawrence and in Northern Ontario.

Flying Club of St. Louis

The new flying field of the Flying Club of St. Louis, Mo., was officially opened on December 12. The field is located at Bridgton, eight miles from the city limits of St. Louis. It has an area of about 180 acres, and there is a large hangar on the field for use of the members. The exhibition flying for the opening was done by Wm. Robertson and Ray Wassall.

Arkansas City Aerial Police

Arkansas City, Kansas, secured its first units of an aerial police force when Mayor C. N. Hunt recently appointed W. H. (Pete) Hill as chief of the aerial police, and Cecil J. Lucas as his aide. Mr. Hill is distributor for the State of Kansas for the Curtiss Company.

Arkansas City is one which has foresight enough to see the possibility of aviation. There are a number of ships which operate out of this town, besides several privately owned ships. There is a large landing field and gas, oil and supplies are always available to all aviators, who are welcome in Arkansas City at any time.

Find Unknown Lakes in Jasper Park, Alta.

Ottawa, Can.—Several hitherto unknown lakes and river valleys have been discovered in Jasper Park, Canadian Rockies, through the use of government aeroplanes. This work was undertaken by the High River Air Station, Alberta, and three experimental flights were carried out over the region for the purpose of exploration and photographic reconnaissance. With the aid of the plane the unknown lakes and rivers were accurately located and valuable information was secured as to the possibility of breaking new trails through the district. Complete reconnaissances were made of mountain peaks, valleys and mountain passes. Information was also secured as to the extent of the timber in the park and communication was kept up with construction gangs working several days' foot journey from the nearest telephone.

Senator Borah and the Mitchell Report

Washington.—All the vital points in the bomb-testing report of Gen. William Mitchell will be laid before the Senate. Senator Borah said on Jan. 4 that when the Naval appropriation bill comes up he will make public the opinions of Mitchell, which were that the battleship is helpless before aerial attacks.

The Senate recently adopted a resolution offered by Borah calling upon Secretary Weeks for the Mitchell report on the bomb-dropping experiments off the Virginia Capes some time ago.

On the ground that it is "incompatible with the public interest," the Secretary informed the Senate he had been directed by the President not to transmit the report.

Immediate notice was given by Borah that he did not consider the publication of the report as "incompatible with the public interest." He called attention to the fact that after the bombing tests one report was given out and widely distributed.

"That report, as I understand," said Borah, "was altogether favorable to one theory of the experiments. Another report was filed which was quite in conflict with that theory. It was filed by Gen. Mitchell. If it should be found to be true that Gen. Mitchell's theory is the correct one and the facts which he gives support his theory, the first report was wholly misleading."

Borah contended that if the first widely published report was in the public interest then the report in contravention of it is entitled to be weighed by the public at the same time.

"The report of Gen. Mitchell might materially affect some of the reputations of those who have been passing upon the efficiency of modern battleships, but it would be very interesting to the taxpayer," he said.

"I think I know practically what is in the report and I will state what it is, and if incorrect I shall rely on the Secretary of War to correct the statement."

Pioneer Instrument Takes Over K-L Fuel System

The Pioneer Instrument Co., of Brooklyn, have taken over the manufacture and sale of the K-L Fuel System formerly handled by the K-L Automotive Specialties Co. Mr. C. B. Kirkham will continue to supervise the engineering work in connection with the apparatus and its installation. This fuel system was described in AERIAL AGE for August 8.

CALENDAR OF COMING EVENTS
under sanction of
AERO CLUB OF AMERICA

April 30th (1 or 2 days)
Spring Show and Opening Meet
Place: Curtiss Field, Mineola, L. I., N. Y.
Conducted by: Curtiss Airplane & Motor Corporation, Garden City, L. I.

September 4th (about) 1-day meet for
Detroit Aerial Water Derby
Curtiss Marine Trophy
Class Race Prizes
Invitation Races
Speed Trophy
Place: Detroit River and Lake St. Clair.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

September 15th (about) 3-day meet
Pulitzer Trophy
Detroit Aerial Derby
for Aviation Country Club of Detroit Trophy and Liberty Engine Builders' Trophy and Class Race Prizes
Invitation Races
Detroit News Aerial Mail Trophy
for Multimotored Aeroplanes Speed Trials
Place: Mt. Clemons Field, Detroit, Mich.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

August 15th (about)
In Preparation by the Aero Club of America
American Elimination Trials, if Necessary for La Coupe Deutsch de la Meurthe (Race to be held in France about October 1st. Place: Mitchel Field, Mineola, L. I., N. Y.

September 30th
First Annual Interservice Championship Meet
Open to the personnel of
The U. S. Army, Navy and Marine Corps Air Service
Championships in Single Seater Fighting Bombing Reconnaissance Races Photography Races Formation Flying, Etc.
Location: Mitchel Field, L. I., N. Y.

August 1st (about)
Foreign Events
Coupe Jacques Schneider
Contest for Flying Boats and Seaplanes
Place: Italy (probably Venice).
Conducted by: Aero Club d'Itali, 24 Via Tor de'Specchi, Rome.
American entries received by the Aero Club of America.

October 1st (about)
Coupe Henry Deutsche De La Meurthe Race for Aeroplanes
Place: France.
Conducted by: Aero Club of France, 35 Rue François-1, Paris.
American entries received by the Aero Club of America.

The AIRCRAFT TRADE REVIEW

American Firm Orders Ocean-Flight Plane

Paris.—An American firm has just ordered an aeroplane of the type described by Louis Breuget, a famous French flier and constructor, as "an ocean-crossing plane." M. Breuget recently predicted that these aeroplanes will be making frequent trips across the Atlantic within two or three years. They are now under construction.

They are expected to be able to fly twenty-four hours without stopping, at a speed of 180 miles an hour, and to carry twenty or thirty passengers, with baggage. This would bring the two continents within a day's travel of each other.

The planes are being planned with huge wings, six feet thick, the interior of which will be used for cabins. As described by M. Breuget, their total weight will be 155 tons, their wing-spread 375 feet, and they will have twenty-four motors of 500 horsepower each.

"There is no reason why an aeroplane could not make the circuit of the world without a stop, if we pursued the formula as to weight-lifting and speed and if greater room can be found for fuel, say 70 per cent. of the total lifting power," says M. Breuget. "Such a plane would travel at a speed of 750 miles an hour, but this speed would be impossible unless an average height of 42,000 feet could be maintained. At such a height the atmosphere has one-fifth of its ordinary density.

"The vista spread out by such a possibility is amazing. Man could fly around the earth faster than the earth's movement. He could, so to speak, catch up with the sun. New York would only be six hours from Europe. Again, in the case of war, what would be the use of big fleets if they were faced with huge 100 and 200 ton aerial torpedo planes? The navies of the world will then be relics of the past, fit only for a place in a museum next, let us say, to mammoths.

"People laugh at these predictions," ended M. Breuget, "but so did people in 1840 when steam navigation was introduced."

Roland Rohlfs Joins Aeromarine

Roland Rohlfs, the famous American pilot and holder of several aeronautic world's records, has joined the Aeromarine Airways, commercial aviation organization, according to an announcement by C. F. Redden, president of the Airways Company. Rohlfs is leaving for Florida, where he will take part in the winter operations to and from Florida coast resorts and points in the West Indies.

"Roland Rohlfs has probably tested more aircraft than any other American pilot," says an official of the company. "Up to the present he has specialized chiefly on military and naval types of aircraft, but like all men experienced in the aeronautical industry, he realizes that the greatest possibilities in aerial activities in this country now rest in commercial aviation and he has chosen America's largest aerial transportation organization for his career.

"The Aeromarine Airways is glad to have Mr. Rohlfs in its organization, and his engagement is part of the Airways' policy to build up a staff of trained and efficient personnel in order to maintain its record of safety and efficiency."

New Goodyear Sales Manager

William C. Young, well known in aero circles, has just been made manager of aeronautical sales of the Goodyear Tire & Rubber Company, succeeding Willard P. Seiberling. Mr. Seiberling, who was aide on the balloon "City of Akron" in the 1921 international balloon race, has joined the new Seiberling Rubber Company established by his father, F. A. Seiberling, former Goodyear president.

Mr. Young is a native of Ohio, a graduate of Hiram College, and won an engineering degree from the University of Virginia in 1915. During the war he qualified as a balloon and dirigible pilot, was stationed for a time at Wingfoot Lake Air Station, Akron, and later was sent to Europe by the U. S. Signal Corps to study aero developments in the war zone. He is a member of the Aero Club of America and the Akron University Club. He has been assistant manager of aero sales at Goodyear since the war.

Air Service Bids

Aeroplanes.—Office of the Chief of the Air Service, Washington.—Bids are wanted until 2:30 p. m., January 31, for item 1, 25 standard bombardment aeroplanes with twin Liberty engines complete; 2, 50 do; together with a quantity of spare parts. Blueprints and specifications covering the proposal will be furnished upon receipt of an application from manufacturers considered to have adequate plant facilities and experience in aeroplane construction if accompanied by a certified check in the amount of $150, made payable to the Chief of the Air Service, to guarantee return of blueprints and specifications within a period of 10 days from date of receipt. Detailed drawings are to be furnished to the successful bidder by the Government.

Aeromarine in the South

Operations in the South have commenced and the Aeromarine Flying Boat Line between Key West and Havana is proving very popular. Within the next week regular service between Miami and Palm Beach and Nassau, in the Bahama Islands, will be inaugurated by the Aeromarine Company.

The Aeromarine Airways has numbered among its pilots some of the finest in the country. They are men who have enviable war records and who have turned the knowledge thus gained to commercial aviation. Among the other pilots who were well known are Major B. L. Smith, who was formerly Naval Attache of the American Embassy in Paris. He was one of the first naval pilots and was then transferred to the U. S. Marine Aviation Corp. Another ex-U. S. Marine aviation pilot is Edward Musick, who flew the Aeromarine eleven-passenger air cruiser "Santa Maria" from Detroit to Chicago and thence down the Mississippi River to New Orleans and to Key West.

George Cobb, an ex-naval aviation officer, is again flying one of the eleven-passenger enclosed-cabin Aeromarine cruisers between Key West and Havana.

The U. S. Army Air Service is represented by D. G. Richardson, formerly a lieutenant and instructor. After the cessation of hostilities, Richardson went to Cuba and became chief of the Cuban Air Service, instructing Cuban aviators on Aeromarine flying boats. He joined the Aeromarine forces last spring and during the summer established a world's record for distance in an Aeromarine-Navy flying boat, circumnavigating the Great Lakes and covering 7,491 miles. In September he opened the Aeromarine New York-Havana service, flying an Aeromarine boat to Havana with four passengers. He left again on the regular monthly route from New York to Havana, carrying four passengers.

De Los Thomas is also an ex-Naval pilot, and a few days after joining the Aeramarine organization he flew the Dempsey-Carpentier fight film out to the steamship Caronia, far at sea, successfully transferring the film and returning to his boat. Last month he left New York in an Aeromarine boat with passengers for Havana and is now flying between Key West and Havana.

A Correction

An error has been noticed in the report of the Contest Committee for the Special Class Efficiency Race held at Omaha on Nov. 5, 1921. Planes Nos. 14 and 61, flown by Buck Weaver and Walter H. Beech, respectively, are reported as having used Liberty Aero Oil. Since making the report I have found that these planes used Lakeside Aviation Oil. The C. L. Maguire Petroleum Company has brought this error to my attention and has asked that I publish the correction.

(Signed)

Ira A. Rader,
Major Air Service.

Orenco D-2 to Dayton

The Orenco D-2 has been shipped to Cook Field, Dayton, for flight test. The D-2 is the latest type of pursuit fighter and promises well as a speedy fighting craft. No details of its dimensions and performance are permitted to be made public at this time.

Sanford Aviation Training Company

The Sanford Aviation Training Co. has just been organized at Brunswick, Ohio. Budd A. Sanford is manager and W. P. Goebel is flying instructor. The mechanical and rigging courses are under the supervision of Henry Simmerly.

BRITISH TESTS FOR AIRCRAFT ENGINES

THE following schedule of standard tests to determine the airworthiness of aircraft engines, issued by the British Air Ministry, is of interest.

General

This schedule comprises four parts, as below, and includes the bench tests and conditions of testing to which all engines supplied to H. M. Government must comply, as well as the bench tests and requirements of the Secretary of State, in accordance with Air Navigation Directions, A. N. D. I., paragraph 21 (i).

Where the conditions in this schedule refer only to engines to be supplied to H. M. Government, a note (*) to this effect has been added:

Part (a) Conditions of tests, definitions of power, etc.
Part (b) Type tests for new designs of engines.
Part (c) Acceptance tests for new engines.
Part (d) Acceptance tests for repair and rectification engines.

Air-worthiness Certificates

In order that a particular engine may be approved by the Secretary of State as airworthy, it is necessary that a sample type engine (which during manufacture has been inspected in accordance with Air Navigation Directions, A. N. D. I., paragraph 20), shall be submitted to type tests, as laid down in Part (b) of this schedule. On the satisfactory completion of these type tests, the Secretary of State will grant an airworthiness certificate for such engines as a type.

Subsequent production engines will be required to be submitted to bench tests, as laid down in Part (c) of this schedule, and the makers must fulfill the conditions of Air Navigation Directions, A. N. D. I., paragraph 21, in order that each engine may be approved as airworthy. Furthermore, in order to check the conditions of manufacture of such subsequent engines, not more than 2 per cent of these engines, as manufactured, will be required to be submitted to a repetition of the type tests, Part (b). Part (d), though intended to apply to Government contracts only, forms a guide to ground engineers as to the most desirable tests for repaired engines.

Part A.—Conditions of Test, Definition of Power, Etc.

1. *Inspection.*—When so required, tests are to be carried out in the presence of the authorized representative of the Secretary of State, and all necessary facilities must be given to this representative to enable him to carry out observations and inspection.

2. *Suitability of Test Plant.*—The test bed conditions, cooling, method of absorbing and measuring horsepower, measuring revolutions per minute, fuel consumption, water and oil temperatures, etc., must be such as to satisfy the requirements of the Secretary of State.

3. *The Test Plant* employed must be capable of fulfilling the following general conditions:

(a) Variation of the brake torque without stopping the engine;

(b) Measurement of the h.p. developed by engine, by means of the torque reaction of the brake or of the engine;

(c) Adequate cooling of the engine.

In order to meet condition (c) for the purpose of power curves and the adjustment of r.p.m. on full throttle test, a variable torque brake is required.

To meet condition (b), a centrally pivoted torque reaction test bench or a balance torque reaction dynamometer or brake is required.

4. *Cooling.*—(a) Water-cooled engines.—Arrangements made must be such that the outlet temperature of the cylinder jacket water can be regulated and maintained steady at not less than 65° C. when measured close to the engine. The supply of water to the suction pipe of the water pump must not exceed a head of, or a pressure equivalent to, 10 feet.

(b) *Air-cooled engines.*—Arrangements for the cooling of the engines must be such as to represent as closely as possible the atmospheric cooling conditions to which the engine is subjected while in flight.

(c) *Oil-cooling.*—Arrangements must be made on all engines working on a circulating oil system to provide means of cooling the oil, and the intake oil temperature must be adjusted to be not less than 50° C. nor more than 70° C. during the tests.

5. *Power Tests.*—(a) All tests, endurance and final, unless otherwise specified by the Secretary of State, will be carried out at 90 per cent of the full power, and at normal r.p.m. All engines must, however, be opened out to full throttle at normal r.p.m. for the last five minutes of all tests (unless otherwise specified by the Secretary of State), and the b.h.p. developed must not be less than full power when corrected for barometer.

(b) Normal r.p.m. is defined as the maximum crankshaft speed at which the engine may be run for long periods as declared by the maker.

(c) Maximum permissible r.p.m. is defined as the maximum safe speed which the engine may be run at for short periods (say five minutes) as declared by the maker.

(d) Full power is the maximum power as declared by the maker at normal r.p.m. when corrected for barometric pressure at which the engine should be run.

6. *Consumption.*—(a) Fuel and oil consumptions will be measured by the total amounts consumed during the endurance test (no corrections being made for the last five minutes' tests), and if these amounts are not within 20 per cent of the maker's declared rates, the maker may be required to withdraw the engine and re-submit it for test, unless in the opinion of the representative of the Secretary of State the consumption can be corrected by adjustment on the dismantling after endurance test. In this case the consumption readings can be again taken on the final test, which must not be less than one hour's duration for this purpose. Should the engine again fail, it must be resubmitted for the endurance and final tests after adjustment or correction.

(b) Where A. I. D. Mark III flow-meters are fitted to test benches, the mean of quarter-hour readings will be accepted in lieu of actual total petrol consumptions provided sufficient calibrated tanks, etc., are available to make an occasional check on the flow-meter readings.

(c) In all cases check consumption readings will be made on final tests.

(d) All tests should be made with the altitude control on the carburetor fixed in the normal running position.

(e) Fuel consumption will be specified in pints per h.p. per hour, and will be calculated from the actual h.p developed, uncorrected for barometer, and no allowance will be made for the last five minutes' test at full throttle.

(f) *Oil consumption.*—For type test the consumption will be given in pints per h.p. hour. For production engines, the consumption will be specified in pints per hour and not pints per h.p. per hour.

(g) *Petrol.*—The standard maker's figures established for each type of engine will be based on tests carried out on some fuel approved by the Secretary of State.

7. *Thrust Test.*—In order to test the thrust bearings, engines may be required to be submitted to the application of a thrust of 6 lbs. per h.p. to the airscrew-shaft during test. This test may be run during or at the conclusion of the endurance test, and under the same conditions of h.p. and r.p.m. as the endurance test. (Testing by means of a suitable airscrew will be accepted for this purpose, if so desired.) If the engines are to be used only for tractor or pusher machines respectively, the thrust must be applied accordingly. If the engines are to be used for either type of machines, a proportion of the thrust tests must be made in each direction. These tests need not apply to rotary engines or to any type of repair or rectification engine.

8. *Slow Running: Vibration and Acceleration Tests.*—At the conclusion of endurance and final tests while the engines are still warm, observations will be made to ascertain that each engine runs reasonably slowly and opens up the normal r.p.m. within five seconds without excessive "popping" or rough periods of running. Engines will be expected to run reasonably at about 50 per cent reduction of speed from normal r.p.m. when the brake has been adjusted for 90 per cent power at normal r.p.m.

9. *Power Curve Tests.*—(a) The brake must be carefully checked over and adjusted if necessary before these tests, and particular attention given to the accuracy of spring balances and weights.

(b) Readings must be taken every 100 r.p.m. from 400 r.p.m.

below normal r.p.m. up to the maximum permissible speed, and down again to 400 r.p.m. below normal. If the maximum permissible speed is a step of 50 r.p.m., a reading will be taken at this speed also.

(c) The engine must be opened up to full throttle at each speed for about three minutes, so that a steady reading of half-minute's duration is obtained, and not a "snatch" observation taken.

10. *Accessories.*—(a) Engines must be run throughout all tests fitted with the carburetors, magnetos, and accessories which will be delivered with them.

(b) Before delivery, engines must be fitted with the carburetor jets of sizes authorized for flight conditions; these jets will not necessarily be the same as those used on the engine test bench.

Particulars of jet sizes will be found in the A. I. D. Standard Jet List.

11. *Failure on Test.*—The failure of any vital part of any engine during test will be held automatically to reject such engine, and, after replacement or rejection of part or parts, the engine must be re-submitted to tests exactly as a new engine.

12. *Preporotion for Despatch.*—Engines which have completed tests, and are prepared for despatch, must comply with the instructions approved by the Secretary of State for the closing of all ports and openings and the prevention of external and internal rust or deterioration while in store.

Part B.—Type Tests for New Designs of Engines

1. *Power Curve.*—A power curve to be taken in accordance with Part A, paragraph 9.

2. *Enduronce Test.*—An endurance test of 50 hours' duration at normal speed at (unless otherwise specified) 90 per cent full power to be taken in accordance with Part A, paragraph 5. This endurance test must include two non-stop runs of 10 hours' duration. Before the last hour of the endurance test, the load will be increased, so that the engine is running at full power at normal r.p.m. until the completion of the test.

3. *Thrust Tests.*—The egnine must run for at least 20 hours with a thrust applied to the airscrew-shaft as described in Part A, paragraph 7. This test may be included in the 50 hours endurance test. Such steps should be non-stop runs to not less than 10 hours' duration.

4. *Slow Running and Accelerotion.*—The engine must be run in accordance with Schedule A, paragraph 8. The duration of the slow running is to be 30 minutes.

5. *High Speed.*—The engine to be run for one hour continuously at 10 per cent in excess of the established maximum permissible speed and under load conditions at the option of the manufacturer.

6. *High Power.*—The engine to be run for one hour continuously at the established maximum permissible speed and at full throttle.

7. *Power Curve.*—Another power curve to be taken in accordance with Part A, paragraph 9.

8. *Dismantling.*—On the completion of the above tests the engine to be completely dismantled for the inspection of the representative of the Secretary of State. On the completion of inspection any defective or unduly worn parts that have been rejected bust be replaced and the engine re-assembled for test.

9. *Final Test.*—If the condition of the engine has been satisfactory it will require to be submitted to a final test of 30 minutes under the same conditions as the endurance test.

10. *Petrol and Oil Consumption.*—The consumption of petrol and oil must be within 20 per cent of the maker's rating taken on any one non-stop run of ten hours running during the 50 hours' duration test. (See Part A, paragraph 6.)

*11. *Petrol Consumption.*—The consumption of petrol must not exceed .56 pints per b.h.p. per hour hour for water-cooled engines, and .60 pints per b.h.p. per hour for air-cooled engines, which will be defined as the average of the consumption per b.h.p. per hour on each period of the 50-hour endurance test.

12. *Oil Consumption.*—The consumption of oil for water-cooled engines must not exceed .025 pints per b.h.p. per hour; for air-cooled engines it must not exceed .045 pints per b.h.p. per hour. (See Part A, paragraph 6.)

*13. Water Pump Delivery.—Engine water pumps will be required to deliver a minimum of 15 g.p.m. per 100 b.h.p. against a circuit resistance of 6 lbs. per square inch.

The following approximate results may be anticipated from pumps suitable for these requirements:

Hydraulic Resistance of circuit	G.P.M. Per 100 B.H.P.
6 lbs. per square inch	15
4 lbs. per square inch	18½
2 lbs. per square inch	22

The pumps must be capable of delivering some water at a pressure of 10 lbs. per square inch at normal r.p.m.

14. *Petrol.*—Type tests will be carried out on any spirit approved by the Secretary of State.

15. *Oil.*—Tests 5 and 6 will be run with a supply of oil in circulation equivalent to the maximum permissible consumption for four hours. No fresh oil may be added during these tests.

Part C.—Acceptance Tests for New Engines

1. *Running In.*—All engines must be "run in" light for a period of not less than two hours until "free" either under their own power on town gas or by being driven from shafting or some other source of power, the r.p.m. of the engine to be at the discretion of the manufacturer.

2. *Tuning Up.*—All engines must be tuned up on petrol for at least a quarter of an hour before endurance tests, and five minutes before final tests, during which time the maker should verify that the engine will open up to full power and will also run slowly, in accordance with the conditions of test, Part A, paragraphs 5 and 8.

3. *Enduronce Test.*—Each engine (unless otherwise specified) will be run for two hours at normal r.p.m. at 90 per cent full power, except for the last five minutes, when the engine will be run at full throttle in accordance with Part A, paragraph 5 (a).

4. *Dismantling.*—On conclusion of the endurance test the engine will be completely dismantled for inspection by the representative of the Secretary of State, or other authorized person, and any worn or defective parts will be rejected and must be replaced. (See Part A, paragraph 11, refailure on test.)

5. *Final Test.*—After re-erection each engine will be run for not less than half an hour under the same condition as for the endurance test. (See Part A, paragraph 7 (a), reincrease of final test to one hour.)

6. *Slow-running Tests.*—At the conclusion of final tests, slow-running and acceleration tests must be made in accordance with Part A, paragraph 8, and should not exceed five minutes' duration.

Part D*—Acceptance Tests for New Engines

1. Running In.—All engines must be "run in" light for a period of not less than one hour until "free" either under their own power or town gas, or by being driven from shafting or some other source of power, the r.p.m. of the engine to be at the discretion of the contractor.

2. *Tuning Up.*—All engines must be tuned up on petrol for at least a quarter of an hour before endurance tests, and five minutes before final tests, during which time the contractor should verify that the engine will open up to full power and will also run slowly, in accordance with the conditions of tests, Part A, paragraphs 5 and 8.

3. *Endurance Test.*—Repair engines will be run for one hour, and rectification engines for at least half an hour at normal r.p.m.., and (unless otherwise specified) at 90 per cent full power, except for the last five minutes, when the engine will be run at full throttle, in accordance with Part A, paragraph 5 (a).

4. *Dismontling.*—On the conclusion of the endurance test, repair engines will be completely dismantled for inspection of the representative of the Secretary of State. Rectification engines will be dismantled as far as it is necessary to examine any enclosed parts which have been fitted in accordance with the rectification schedule. Any worn or defective parts will be rejected and must be replaced. (See Part A, paragraph 11, refailure on test.)

5. *Final Test.*—After re-erection each engine will be run for not less than a quarter of an hour under the same conditions as for the endurance test.

6. *Slow-running Test.*—At the conclusion of final tests, slow-running and acceleration tests must be made in accordance with Part A, paragraph 8.

Note.—A rectification engine is one which has been partially dismantled to embody Class I and II modifications, and has not been dismantled for overhaul or repair.

THE "SYLPHON" FUEL SYSTEM FOR LIBERTY "12" AND WRIGHT MODEL "H" ENGINES

General

The sylphon pump was designed to fill the need for an engine-driven fuel pump in order to obviate the use of air pressure where sufficient gravity head is not available. The name is derived from the metallic bellows, the trade name of which is "Sylphon," which is the characteristic feature of this pump. This type of pump was selected because it requires no packing gland and also because it gives a maximum discharge pressure at high speeds and sufficient fuel at any speed, thus doing away with a relief valve. It is built in duplex form so that in case one pumping unit fails the other unit will maintain sufficient fuel supply for all engine speeds.

Nearly two years of service in flight at McCook Field and a 1,400-hour bench test at full capacity have revealed no failures of any kind. This performance, however, can be expected only when proper care, which is due any mechanism of this nature, is maintained.

At present this pump is produced for use on the Liberty "12" and Wright Model "H" engines. The only difference between the two models is in the drive shaft and base casting flange. The assembly drawing number of the Liberty "12" pump is 047280 and that of the Wright Model "H" is 047281.

General Description

The Liberty "12" pump will be described, but the description for the Model "H" is the same, except that the splined drive shaft (045289) and the base casting (045266) on the Liberty are replaced on the Model "H" by parts numbers 045280 and 045267, respectively. The nut on the end of the magneto drive shaft of the Model "H" must be removed and replaced by nut (045458) which is furnished with the pump. The Liberty pump is driven directly from the crank shaft.

A four-pitch worm (045305) in figure 1 meshes with a 32-tooth worm wheel (045291) giving an 8 to 1 reduction. The worm wheel is attached to a cam shaft (045284), which actuates cam follower rollers (045287) attached to cam followers (045286). The cam followers extend into the sylphon flange (045259) to which the sylphon (045308) is soldered. The upper end of the sylphon is soldered to the sylphon headplate (045436), which is secured in position by machine screws (SP-2446). The sylphon chamber (047277) also contains the inlet and outlet valve assemblies (047282) and (045276), respectively. As the worm rotates the worm wheel in the cam shaft moves the plungers down only, admitting fuel from the main tank to the sylphon, which is returned to its original position by the spring (045282) designed to give a maximum pressure of 4½ pounds per square inch with a closed discharge.

The worm-drive shaft (045289) is threaded onto the worm and butts against the ball bearing. The worm-bearing cage holds the bearing position. The worm-bearing cage retainer is grooved for felt packing to keep oil in the pump, and fits just outside of the worm-bearing cage. The worm-bearing cage (045260) and the worm-bearing cage retainer are attached to the pump base by machine screws. The pump base cap (045302) is the bronze bearing on the other end of the worm.

The cam followers (045286) operate in the cam-follower bearings lower (045304) and upper (045288), which are bronze bushings. The upper bearings are in the cam-shaft support (045264) and the lower bearings in the pump base (045266). The cam shaft operates in aluminum bearings in the cam shaft support.

There are two intake and two outlet valves, each a unit, screwed into the valve chamber, which is the upper part of the sylphon chamber casting. The valve chamber has a partition, on one side of which are the two intake valves, and on the other side the two outlet valves.

A hole, having ⅛-in. pipe thread about one-half way down on one side of the pump, is utilized as a drain in case a gasket leaks or a sylphon breaks.

Two outlets and two inlets are provided for convenience in installation. Only one of each is necessary. The pipe plugs are inserted to prevent dirt getting in the valves in shipping and stocking.

The pipe plug in the bottom of the base is permanent and should be removed only to refill the base with lubricant.

Disassembly

To disassemble the pump, first unthread, but do not remove, screws (SP 2446) on top of the sylphon chamber.

Remove screws which join sylphon chamber, cam-shaft support (045264), and pump base (045266).

Tap lightly on upper screws (SP 2446) until bond between gasket (045429) and sylphon chamber is broken. (This prevents sylphons from being stretched.)

Lift off sylphon chamber (045277).

Carefully lift off cam-shaft support (045264). This part carries the worm wheel and is doweled on to pump base (045266), giving correct alignment with worm (045305).

The worm wheel is removed by unscrewing machine screws (SV 2533).

The worm (045305) can be removed by withdrawing cotter on engine shaft (045289), unscrewing same, pulling worm-bearing cage retainer (045261), worm-bearing cage (045260), and ball bearing, then removing worm (O453O5).

The cam-follower bearings upper (045288) and lower (045304), the pump base cap (045302), and worm bearing cage (045260) are of bronze, pressed in.

The four valve assemblies are in units. These can be removed by means of a broad screw driver.

Installation

The Liberty "12" pump has a splined drive which fits into the rear end of the crank shaft. It is attached by nuts holding it down to six studs on the rear of the crank case. Figure

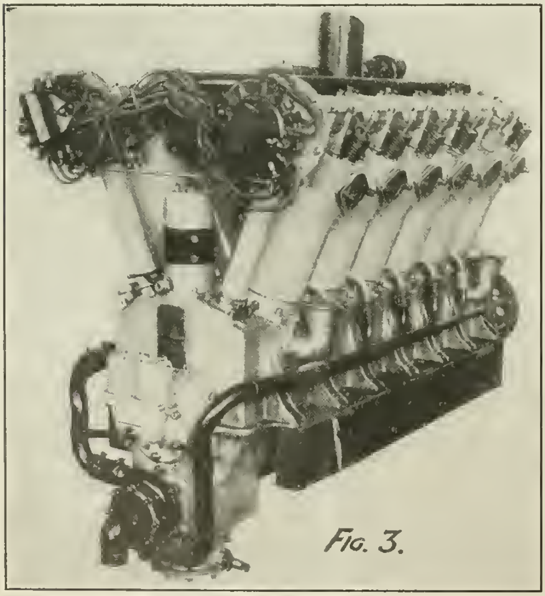

Fig. 2. Pump on Liberty 12 Engine

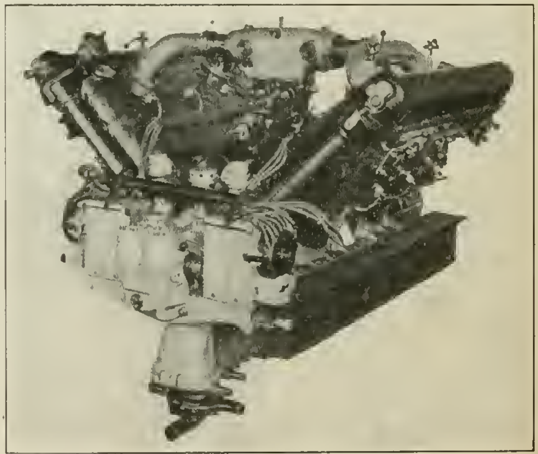

Fig. 3. Pump on a Wright Model "H" Engine

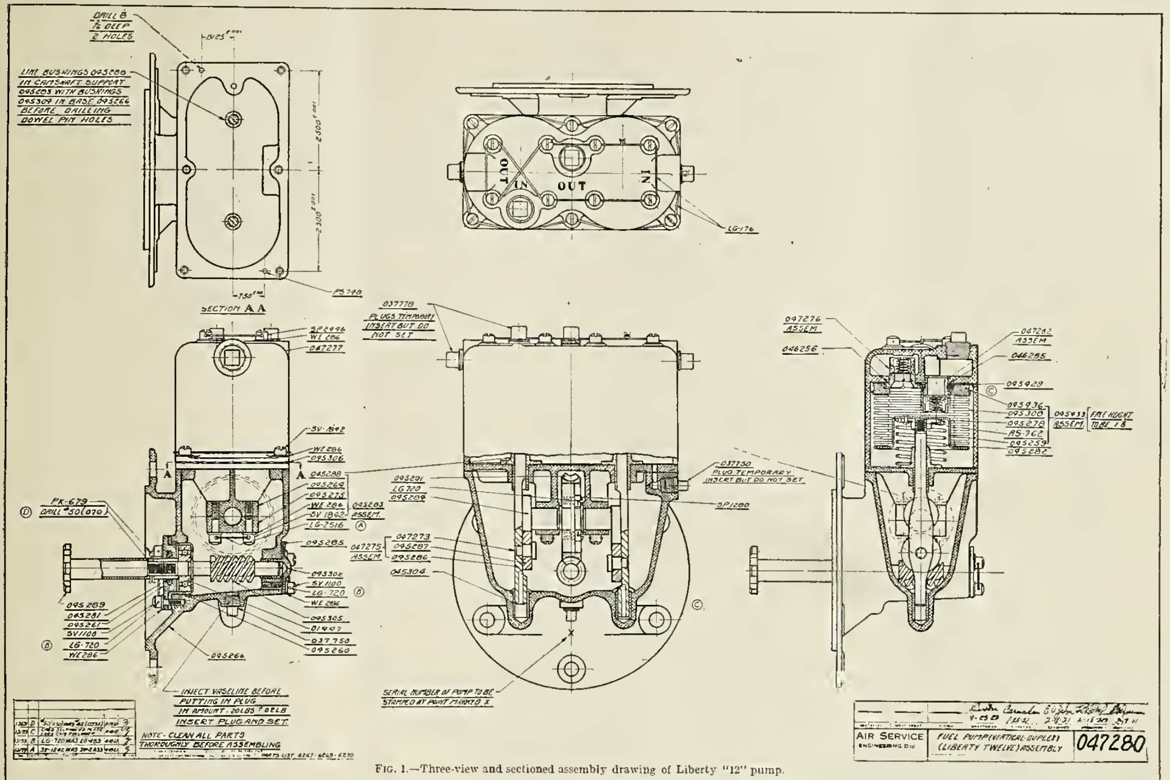

FIG. 1.—Three-view and sectioned assembly drawing of Liberty "12" pump.

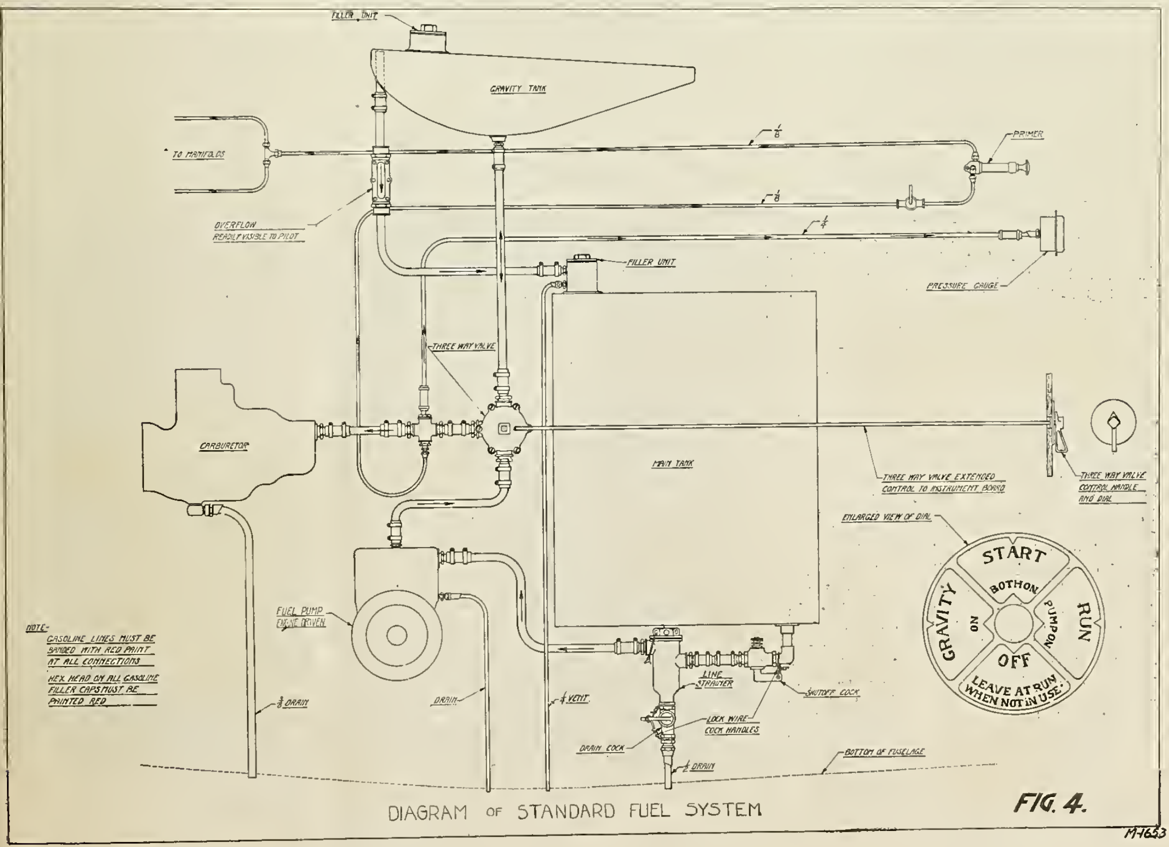

DIAGRAM OF STANDARD FUEL SYSTEM

FIG. 4.

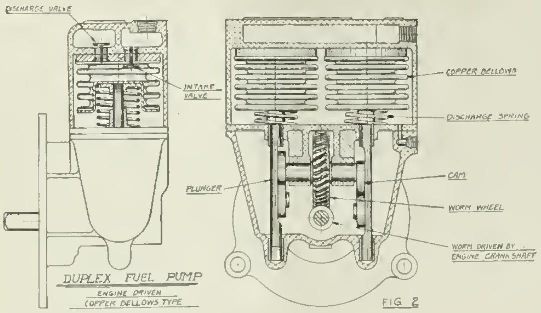

FIG 2

2 shows this pump mounted.

The Wright Model "H" pump has a square drive which fits into a special nut which replaces nut (11240) on the end of the magneto drive gear shaft (13127). It is attached to the rear end of the magneto bracket. Figure 3 shows this pump mounted.

Either "in" and either "out" may be used in piping these pumps. The "in" and "out" not used must be plugged. Care must be taken not to get dirt into the valve chamber when this work is done.

The ⅛-inch pipe thread tapped hole about half way down on one side should be piped through the bottom of the fuselage. This acts as a drain in case of gasket leak or other failure, thus reducing fire hazard.

Figure 4 shows a typical piping installation using this type of pump.

Precautions

Study figure 1 and read "Disassembly" carefully before attempting disassembly. Lock all screws with wire in reassembling.

The pump base should be thoroughly cleaned of lubricant, and about one-fifth of a pound of fresh vaseline put in every 300 hours of service.

Do not use rubber for gasket material. "Goodyearite," "Vaporite," "Seigelite," or other strong sheet with flax or asbestos fibre is satisfactory.

In reassembling, before putting on sylphon chamber, line up holes in top sylphon heads and no trouble should be experienced in threading screws into place.

Before assembling, see that valves are clean and working properly.

In reassembling, see that sylphon height from bottom of lower head to top of upper head is 1⅞ inches.

Actuating springs should have a tension of 12¼ pounds, plus or minus ¼ pound, when compressed to 1¼ inches.

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THE TRUTH ABOUT COMMERCIAL AVIATION

THE Society of Automotive Engineers, whose membership is composed of some 5,000 of the foremost engineers and executives connected with the automotive industry, held during the month of December a number of meetings in the principal cities, at which different members of the organization and other competent authorities have given some highly interesting facts concerning the recent progress in commercial aviation.

Contrary to the general belief, it was brought out that America is not behind Europe in the development of aviation, but that it surpasses any other country in the number of miles flown. Regularity of service, it is true, is more marked in Europe, where the government's subsidies are based upon the number of miles flown, but the actual cost of operation here appears to be no higher than abroad.

Asst. Postmaster General Shaughnessy, speaking at Philadelphia, told of the progress recently made in the air mail service, and stated that during the third quarter of this year 391,000 miles were flown and that over 10,000,000 letters were carried; 97 per cent. of the scheduled trips were completed on time and no injuries were suffered on regular trips during this entire period. The cost of operation, which was $8.00 per ton-mile in 1920, was reduced to $6.00 per ton-mile in 1921, and with improved design of machine now being put into use, will be reduced to $2.60 per ton-mile.

C. F. Redden, general manager of the Aeromarine Airways, at a meeting in New York spoke convincingly of the fact that commercial aviation has actually arrived and stated that the problem is now largely one of inducing people to take advantage of the opportunities that are available for commercial flight. Since the cost of operating a large passenger carrying machine is largely independent of the number of persons carried, it is evident that as traffic increases and planes are enabled to fly with approximately full loads, the cost per passenger will decrease.

J. G. Vincent, who flew from Dayton to Indianapolis for the purpose of attending the meeting there and who also spoke at St. Louis, gave a clear analysis of the economic possibilities of the aeroplane for commercial work. He indicated the factors now impeding the growth of aerial transportaton and suggested ways of overcoming these obstacles.

Glenn L. Martin in Chicago stated that the comparatively high cost of speedy transportation by air is no more of a bar to its use than is the higher cost of taxicab transportation over that of the street cars.

Other speakers touched upon various different phases of the situation, such as landing fields, radio and meteorological service, ground organizations, improvements in design and the relation of civil aviation to national defense. A number of speakers supported the Wadsworth bill for the federal control of civil aviation.

The remarkable attendance at all of the meetings was evidence of the popular desire for an authoritative progress report on flying as a business proposition.

View in the Gallaudet Aircraft Factory showing two of the Gallaudet Nacelles Housing the Gallaudet Multiple Drive

THE CHOICE OF WING SECTIONS FOR AEROPLANES

EDWARD P. WARNER

Secretary, Committee on Aerodynamics National Advisory Committee for Aeronautics.

(*Technical Note Naturol History Committee for* AERIAL AGE)

(*Continued from page* 420)

Treating the same illustrative problem as before, tabulating the various quantities involved for each section, a new order of merit is obtained.

Section	$C_{L max.}$	$\sqrt{C_{L max}}$	$\sqrt[6]{C_{L max.}}$
U.S.A. 5	1.290	1.133	1.042
15	1.184	1.088	1.028
16	.992	.996	.999
17	1.082	1.040	1.013
21	.913	.955	.985
27	1.411	1.188	1.059
U.S.A.T.S. 5	1.512	1.230	1.072
10	1.732	1.317	1.096
13	1.294	1.138	1.044
R.A.F. 6	1.200	1.095	1.031
15	1.109	1.053	1.017
Göttingen 387	1.640	1.280	1.086

Section	$\frac{42,800 P^2}{\sqrt{C_{L max.}} V^2_{min.} W^2_o}$	L/D	$L/D \times \sqrt[6]{C_{L max.}}$
U.S.A. 5	.100	6.60	6.87
15	.104	7.37	7.58
16	.114	7.67	7.66
17	.109	8.01	8.11
21	.119	7.73	7.61
27	.095	6.93	7.34
U.S.A.T.S. 5	.092	6.65	7.13
10	.086	6.14	6.73
13	.100	6.34	6.62
R.A.F. 6	.104	6.87	7.08
15	.108	7.60	7.73
Göttingen ..387	.089	6.66	7.23

The relative merit of the sections as shown by this table is almost identical with that determined from the analysis with changes of weight ignored. In all practical problems the simpler type of treatment, by which the relative efficiencies are read off directly from the L/D chart, will suffice.

This case, like the one in which the weight is assumed constant, can readily be treated on the assumption of a fixed parasite resistance coefficient in place of that of a fixed ratio of parasite resistance to wing drag. As has just been shown, however, the difference between the results with the two assumptions is so small that it would hardly be worth carrying through another example.

These methods of comparison, while accurate, are rather complex, and it is worth while seeking a somewhat simpler device. Such a device can readily be obtained for the case of landing speed and constant weight. Writing the equation,

$$D = \frac{W}{L/D} = \frac{W}{\frac{C_{L max.}}{C_D} \times \frac{C_L}{C_{L max.}}} = \frac{W}{\frac{C_{L max.}}{C_D}} \times \left(\frac{V}{V_{min.}}\right)^2$$

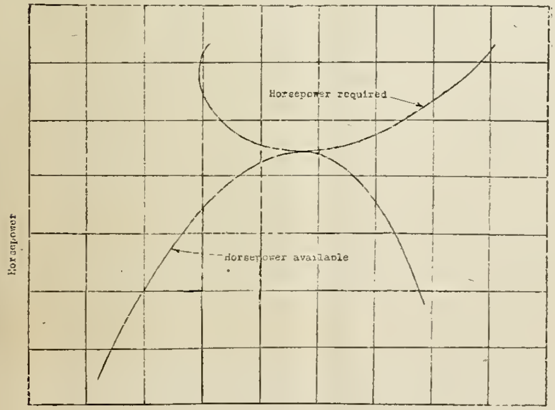


Fig. 3

Since all aeroplanes having a speed ratio of from 1.9 to 2.8 (all, in short, except a few with an exceptionally high power loading) fly when at maximum speed at an angle of attack close to that of minimum drag, and since the drag coefficient curve is very flat in the neighborhood of its minimum ordinate, little error will result from inserting $C_{D min.}$ for C_D in the above equation. In general, therefore, the wing best suited for maximum speed is that for which the value of $\frac{C_{L max.}}{C_{D min.}}$ is highest. The value of this ratio has been tabulated below for a few wing sections, all tested at the Massachusetts Institute of Technology, wind tunnel under the same conditions.

Aerofoil	$\frac{C_{L max.}}{C_{D min.}}$
U.S.A. 5	44.9
15	53.0
16	52.9
17	60.4
21	52.7
27	50.7
U.S.A.T.S. 5	43.6
10	36.8
13	35.0
Göttingen 387	44.5
R.A.F. 6	42.0
15	57.8

C. *Choice of Section for Maximum Speed Range Ratio*

Writing, as in (b), the equations of maximum and minimum speed, with appropriate allowance for dependence of weight on area:

$$C'_D V^3_{max.} = \frac{220 P}{\frac{\rho}{2} S}$$

$$V_{max.} = \sqrt[6]{\frac{48,400 P^2}{\left(\frac{\rho}{2}\right)^2 S^2 {C'_D}^2}}$$

$$W = C_{L max.} \frac{\rho}{2} S V^2_{min.}$$

$$V_{min.} = \sqrt[6]{\frac{W^3}{C^3_{L max.} S^3 \left(\frac{\rho}{2}\right)^3}}$$

$$\frac{V_{max.}}{V_{min.}} = \sqrt[6]{\frac{48,400 P^2 S C_L{}^3_{max.} \frac{\rho}{2}}{W^3 {C'_D}^2}} = \sqrt[6]{\frac{57.5 P^2 S C_L{}^3_{max.}}{W^3 {C'_D}^2}}$$

Substituting K $S^{1/6}$ for W,

$$\frac{V_{max.}}{V_{min.}} = \sqrt[6]{\frac{57.5 P^2 C_L{}^3_{max.}{}^{12}}{K^3 {C'_D}^2}} \times \sqrt{S}$$

It therefore appears, since S is a variable quite independent of all the rest, that speed range ratio can be increased without limit by a sufficient increase in wing area. The gain is, however, very slow, an increase of 50% in area raising the ratio by only 4%. The comparison of wing sections can be made most reasonably by assuming a constant area. If this be done, the best section is that giving the highest value of $\frac{C_L{}^3_{max.}}{{C'_D}^2}$, where

C'_D is the drag coefficient at an angle so chosen that

$$\sqrt[6]{\frac{57.5\ P^2\, C^3_{L\,max.}}{K^3\, C'^2_D}}\times\sqrt[12]{S}=\sqrt[6]{\frac{C_{L\,max.}}{C'_L}}$$

$$\frac{\sqrt[3]{C'_D}}{\sqrt{C'_L}}\sqrt[6]{\frac{57.5\ P^3}{K^3}}\times\sqrt[12]{S}$$

$$\frac{C'^2_D}{C'^3_L}=\frac{57.5\ P^2\ S^{1/2}}{K^3}$$

Since S is assumed to have been initially fixed, both S and W can be considered as constants, and

$$K^3=\frac{W^3}{\sqrt{S}}$$

$$\therefore\frac{C'^2_D}{C'^3_L}=\frac{57.5\ P^2\ S}{W^3}$$

the same condition as was initially found to define maximum horizontal speed in case (a). The original plot of L/D against $\frac{C_D^2}{C_L^3}$ can therefore be used, the angle of attack which gives the appropriate value of $\frac{C'^2_D}{C'^3_L}$ being determined and the cube of the maximum lift coefficient of the wing under consideration being divided by the square of the drag coefficient at the angle thus determined. The best section is the one showing the largest value for this quantity.

Returning to the same problem as before,

$$\frac{57.5\ P^2\ S}{W^3}=.0795$$

Section		$C_{L\,max.}$	$(L/)^1$	C'_D	$\frac{C^3_{L\,max.}}{C'^2_D}$
U.S.A.	5	1.290	6.59	.0443	1616
	15	1.184	7.28	.0325	1306
	16	.992	7.38	.0314	792
	17	1.082	7.81	.0263	1236
	21	.913	7.34	.0318	616
	27	1.411	7.03	.0365	2039
U.S.A.T.S.	5	1,512	6.81	.0400	2219
	10	1.732	6.46	.0467	2858
	13	1.294	6.34	.0494	1121
R.A.F.	6	1.200	6.78	.0404	1090
	15	1.109	7.40	.0310	1133
Göttingen	387	1.640	6.93	.0380	2956

The advantage in this comparison clearly rests very strongly with the thick, high-lift sections.

If the assumption of constant parasite resistance is made, the problem becomes to find the wing with the highest value of $\frac{C^3_{L\,max.}}{(C'_D+.04)^2}$ where C'_D is determined by the condition:

$$\frac{(C'_D+.04)^2}{C'^3_L}=\frac{230\ P^2\ S}{W^3}$$

$(C'_D+.04)^2$.

This solution would show the thick wings, all of which have high minimum drag coefficients, in an even more favorable light than the preceding one.

D. Choice of Section for Maximum Rate of Climb

Although the air speed for best climb is not in general identical with that for minimum power required, nevertheless the two are close enough together so that the problem of securing a maximum rate of climb reduces itself essentially, provided that the weight remains constant, to the problem of cutting down to as low a value as possible the minimum power required for horizontal flight.

The rate of climb can be expressed by the equation:

$$C=\frac{\eta P}{W}-\frac{(C_D\ S+C_R)\ \frac{\rho}{2}\ V^3}{W}$$

where c is the rate of climb.

If it be assumed that the parasite resistance is 40% of the total resistance under conditions of best climb and that the propeller efficiency is 75%, the equation becomes:

$$C=\frac{412\,P}{W}-\frac{5/3\,C_D\,S\,V^3}{C_L\,S\,V^2}=\frac{412\,P}{W}-\frac{5\,V}{3\,L/D}$$

In this case, as in that of maximum speed, the area may be treated either as a constant or as a variable. If S be taken as fixed at the same value for all wings W is also a constant, and the problem becomes simply one of making $\frac{L/D}{V}$ as large as possible. With W and S constant,

$$V=\sqrt{\frac{W}{\frac{\rho}{2}S}}\times\sqrt{\frac{1}{C_L}}$$

$$\frac{L/D}{V}\ \alpha\ \frac{L}{D}\times\sqrt{L_C}$$

and the maximum value of this function can be found by plotting it directly against angle.

For a more accurate analysis the equation given above is not quite satisfactory, as it leads to emphasizing the properties which the wing possesses at an angle smaller than that of best climb. It is better, instead of taking the parasite resistance coefficient as a certain proportion of the wing drag coefficient, to take it as an additive constant. The average value of this constant as already noted, is .04 A. Therefore

$$C=\frac{412\ P}{W}-\frac{(C_D+.04)\,\frac{\rho}{2}S\ V^3}{C_L\,\frac{\rho}{2}S\ V^3}=\frac{412\ P}{W}-\frac{(C_D+.04)\ V}{C_L}$$

If the weight and area are constant, therefore, the best wing for climb is that which has the largest maximum value of $\frac{C_L^{3/2}}{C_D+.04}$, a function the maximum value of which for each section must be found by computing it directly for a few angles and plotting against angle.

If the area is allowed to vary without restriction, the weight being assumed to depend on area in the same manner as heretofore, the equation becomes:

$$C=\frac{412\ P}{KS^{1/6}}-\frac{(C_D+.04)\sqrt{\frac{K\ S^{1/6}}{S}}\sqrt{\frac{1}{\rho/2\ C_L}}}{C_L}=$$

$$\frac{412\ P}{K\ S^{1/6}}-\frac{(C_D+.04)\sqrt{K}}{S^{5/12}\ C_L^{3/2}\ (\frac{\rho}{2})^{1/2}}$$

$$\frac{dC}{dS}=-\frac{69\ P}{KS^{7/8}}+\frac{5\ (C_D+.04)\sqrt{K}}{12\ S^{17/12}\ C_L^{3/2}\ (\frac{\rho}{2})^{1/2}}$$

considering C_D and C_L as constants. For maximum climb

$$\frac{69\ P}{KS^{7/6}}=\frac{5\ (C_D+.04)\sqrt{K}}{12\ S^{17/12}\ C_L^{3/2}\ (\frac{\rho}{2})^{1/2}}$$

$$\frac{5.61\ P}{K\ S^{7/6}}=\frac{(C_D+.04)\sqrt{K}}{S^{17/12}\ C_L^{3/2}}$$

$$\frac{5.61\ P\ S^{1/4}}{K^{3/2}}=\frac{C_D+.04}{C_L^{3/2}}$$

Substituting the value just determined for $S^{1/4}$,

$$C=\frac{1}{S^{1/6}}\left[\frac{412\ P}{K}-\frac{(C_D+.04)\sqrt{K}}{C_L^{3/2}\ (\frac{\rho}{2})^{1/2}}\times\frac{5.61\ PC_L^{3/2}}{K^{3/2}\ (C_D+.04)}\right]=$$

$$\frac{1}{S^{1/6}}\overset{2}{\left[\frac{412\ P}{K}-\frac{166\ P}{K}\right]}=\frac{246\ P}{KS^{4/6}}=\frac{246\ P}{W}$$

$$S^{1/6}=\left[\frac{(C_D+.04)\ KS^{1/6}}{5.61\ P\ C_L^{3/2}}\right]^{2/3}$$

$$C=\frac{246\ P}{K}\left[\frac{5.61\ P\ C_L^{3/2}}{(C_D+.04)\ K^{3/2}}\right]^{2/3}=\frac{777\ P^{5/3}\ C_L}{(C_D+.04)^{2/3}\ K^2}=$$

$$\frac{777\ P^{5/3}}{K^2}\left(\frac{C_L^{3/2}}{C_D+.04}\right)^{2/3}$$

The values of K for a few modern aeroplanes are tabulated below:

	K
D. H. 4	1300
Vought V. E. 7	820
Curtiss JN4D	760
Fokker D7	800
Martin Bomber	3200
Handley-Page (4-engined)	6350
Thomas-Morse MB3	830

As a further basis for comparison, the maximum values of $\frac{C_L^{3/2}}{C_D+.04}$ have been calculated for several good aerofoil sections, all of which have been tested under the same conditions at the Massachusetts Institute of Technology, and are tabulated at the end of this section.

As illustrations, the theoretical best area will be calculated for aeroplanes of the type of the Vought and Martin Bomber, assuming the U. S. A. 15 wing to be used in both cases.

Vought

$$S=\left[\frac{(C_D+.04)\ K^{3/2}}{5.61\ P\ C_L^{3/2}}\right]^4$$

$$\frac{C_D+.04}{C_L^{3/2}}=\frac{1}{8.65}=.116\ \text{(see Table).}$$

$K=820$

$P=180$

$A=(2.68)^4=51\ \text{ft.}^2$

Martin

$K=3200$

$P=\ 800$

$$A=\left(.116\times\frac{3200\times56.6}{5.61\times800}\right)^4=(4.64)^4=460\ \text{ft.}^2$$

It will be observed that these optimum areas are far below those actually employed, and we conclude that the rate of climb at ground level could be materially improved for most present-day aeroplanes by decreasing the area. This, however, would be very injurious to the ceiling and the rate of climb at high altitudes. If the best area is to be found for rate of climb at 10,000 feet, for example, instead of at sea level, the engine power being reduced by 28% and the power required for flight at a given angle of attack being increased by 18%, the equating to zero of the derivative of the rate of climb gives:

$$.72\times\frac{69\ P}{KS^{7/6}}=\frac{1.18\times5\ (C_D+.04)\sqrt{K}}{12\ S^{17/42}C_L^{3/2}\left(\frac{\rho}{2}\right)^{1/2}}$$

$$\frac{3.42\ P\ S^{1/4}}{K^{3/2}}=\frac{C_D+.04}{C_L^{3/2}}$$

The best area for rate of climb at 10,000 feet is therefore 6.55 times as large as for rate of climb at sea level. This works out at 330 square feet for the Vought, 3030 square feet for the Martin, the first figure slightly larger, the second much larger that the areas actually employed. The optimum area for any given type of aeroplane runs up very rapidly as higher altitudes are considered, approaching infinity as the ceiling is approached.

Whatever altitude may be taken as a basis, however, and whatever may be the type of aeroplane, the aerofoil section which gives the best rate of climb with a free choice of aera is the section which gives the largest maximum value of $\frac{C_L^{3/2}}{C_D+m}$, and .04 is a good average value for m.

It should be remembered, of course, that this discussion has been based on an implicit assumption that the propeller, as well as the wing section, is to be chosen for climb alone. If this were the case, most aeroplanes would climb best at an angle of attack of about 10°, under which conditions $\frac{C_L^{3/2}}{C_D+.04}$ reaches its maximum. In service aeroplanes, however, the propeller is usually designed for best performance in the neighborhood of the maximum horizontal speed, and the propeller efficiency falls off rapidly with decreasing speed of flight. The best climb in actual practice is therefore obtained at an angle of attack of about 6° at sea level in most cases, and the wing performance in terms of power consumed under those conditions is approximated to by the maximum value of $\frac{C_L^{3/2}}{C_D}$, as already noted.

There are, then, two excellent criteria of rate of climb, the maximum value of $\frac{C_L^{3/2}}{C_D+.04}$ and that of $\frac{C_L^{3/2}}{C_D}$. The first is especially suited for judging performance at high altitudes and for use in connection with aeroplanes which have a very small speed range ratio, or which, like some commercial and bombing types, are designed for economy rather than for extreme speed and ceiling and which accordingly employ propellers giving their best efficiency at a speed considerably below the maximum.

To facilitate comparison, both criteria have been tabulated together for a dozen good wing sections.

		$\frac{C_L^{3/2}}{C_D+.04}$	$\frac{C_L^{3/2}}{C_D}$
U.S.A.	5	9.05	13.31
	15	8.66	13.13
	16	7.75	12.38
	17	8.29	12.51
	21	7.03	12.26
	27	9.05	13.38
U. S. A. T. S.	5	8.85	11.78
	10	9.31	12.59
	13	8.79	11.92
R. A. F.	6	8.49	12.69
	15	8.10	12.06
Göttingen	387	9.21	12.32

If the wing area, instead of being varied at will, is kept constant, it is obvious that maximum climb reduces simply to a question of minimum power consumption, and that the same two criteria hold as in the previous case, with the same general rules governing the choice between them. The numerical relations between the climbing speeds with any particular pair of aerofoils, are, however, very different for the fixed and for the variable area.

The case of best climb for a given landing speed is rather complex to treat, and arises so rarely that discussion is hardly worth while.

E. Choice of Wing Section for Maximum Absolute Ceiling

In this case, as in the last one, it will be assumed that the best possible propeller for the particular characteristic under examination is employed.

It can readily be shown that the best propeller for ceiling is one which causes the curves of power available and power required to meet at the ceiling in such a way that their common tangent is horizontal, as shown in Fig. 3. Furthermore, it appears that if such a propeller is used, the ceiling depends only on the ratio of maximum power available at sea level to minimum power required at sea level.

Since power available is dependent neither on wing characteristics nor on weight, the requirement for maximum ceiling reduces itself to a simple matter of keeping the minimum power required for horizontal flight as small as possible. This condition has already been treated for the case of a fixed wing area, under (D), where it was shown to be roughly true that minimum power is required with the section which gives the largest value of $\frac{C_L^{3/2}}{C_D+.04}$.

It is impossible to find a "best area" for ceiling, as was done for rate of climb, as it is theoretically possible to increase the ceiling without limit by sufficiently increasing the area. A practical case which does arise frequently, however, is that in which it is desired to obtain maximum ceiling in conjunction with a given maximum speed. In order to secure the same maximum speed on the same type of aeroplane with several different wing sections, the areas must obviously be different. To determine the area for a given maximum speed with each section, the analysis undertaken in the early part of the paper must be carried further.

It has already been shown that

$$\frac{C_D^2}{C_L^3} = \frac{57.5\ P^2\ \sqrt{S}}{K^3}$$

and

$$\frac{L}{D} = \frac{W\,V}{220\ P} = \frac{K\,V\,S^{1/6}}{220\ P}$$

if the weight be assumed proportional to the sixth root of the area. Therefore,

$$\frac{\dfrac{C_D^2}{C_L^3}}{\left(\dfrac{C_L}{C_D}\right)} = \frac{6110\ (10\ P)^5}{K^6\ V^3}$$

If a value of V be chosen and K be assumed and the power is known it is now possible to solve for

$$\frac{\dfrac{C_D^2}{C_L^3}}{\left(\dfrac{C_L}{C_D}\right)^3}$$

and the point at which the prescribed value occurs for any particular section can readily be determined by trial from the curve of $\frac{L}{D}$ against $\frac{C_D^2}{C_L^3}$, dividing the abscissa by the cube of the ordinate. This point being located, the abscissa is multiplied by the square of the ordinate to find the lift coefficient and so the area.

$$\frac{C_D^2}{C_L^3}\times\left(\frac{C_L}{C_D}\right)^2 = \frac{1}{C_L} = \frac{\frac{d}{2}\,S\,V^2}{W} = \frac{\frac{d}{2}\,S\,V^2}{K S^{1/6}} = \frac{\frac{d}{2}\,S^{5/6}\,V^2}{K}$$

$$S = \left[\frac{K}{\frac{\rho}{2}\,V^2}\times\frac{C_D^2}{C_L^3}\times\left(\frac{L}{D}\right)^3\right]^{6/5}$$

The maximum area permitting of a given maximum speed is thus determined.

The minimum HP required is:

$$P_{\min.} = \frac{(C_D + .04)\,\frac{\rho}{2}\,S\,V^3}{550} = \frac{(C_D + .04)\,S\,W^{3/2}\,\frac{\rho}{2}}{550\,S^{3/2}\,C_L^{\,3/2}\left(\frac{\rho}{2}\right)^{3/2}}$$

$$= \frac{(C_D + .04)\,K^{3/2}}{18.9\,C_L^{3/2}\ S^{1/4}}$$

The section giving the best ceiling with a given maximum speed is therefore the one giving the lowest minimum value of $\frac{C_D + .04}{C_L^{3/2}\ S^{1/4}}$, where A is calculated in accordance with the procedure described in the preceding paragraph.

To illustrate the use of this method, another problem will be worked. Given a pursuit aeroplane with a 300 HP engine and K equal to 1000 (the value corresponding to a weight of 2500 lbs. and an area of 240 sq. ft.), the problem is to choose the wing section giving the highest ceiling in conjunction with an air speed at sea level of 140 m.p.h., or 205 ft. per sec. This problem, like the preceding ones, can best be solved by systematic tabulation.

$$\frac{1940\ (10\ P)^5}{K^6\ V^3} = \frac{6110\ (3000)^5}{1000^6\times 205^3} = .000172$$

Section		: $\frac{C_D^2}{C_L^3}$	: $\frac{L}{D}$	: A	: Min. $\frac{C_D + .04}{C_L^{3/2}\,S^{1/4}}$	: Rank
U.S.A.	5	.0722	7.53	198	.0294.........	4
	15	.0840	7.93	268	.0285.........	2
	16	.0924	8.18	325	.0305	
	17	.0962	8.21	344	.0280.........	1
	21	.0957	8.20	340	.0331	
	27	.0743	7.61	210	.0290.........	3
U.S.A.T.S.	5	.0676	7.37	174	.0311	
	10	.0595	7.03	133	.0315	
	13	.0664	7.31	166	.0317	
R.A.F.	6	.0750	7.65	215	.0308	
	15	.0891	8.09	303	.0296.........	5
Gottingen	387	.0674	7.34	171	.0299.........	6

The thin sections thus appear to have some advantage over the best of the thicker ones, but, as already pointed out, this method hardly gives due weight to the great structural advantages of the thick section. A somewhat fairer comparison between sections of widely different thickness can be made by assuming a constant resistance coefficient of .0001 throughout. It is obvious from what has gone before that if this be done the limiting condition at maximum speed becomes:

$$\frac{62{,}100\ \ (10\,P)^5}{K^6\ V^3} = \frac{(C_D + .04)^2}{\left(\dfrac{C_L^3}{C_D + .04}\right)^3}$$

and the area equation is:

$$S = \left[\frac{K}{V^2}\times\frac{(C_D + .04)^2}{C_L^3}\times\left(\frac{C_L}{C_D + .04}\right)^2\right]^{6/5}$$

while the final criterion of merit is the minimum value of

$$\frac{C_D + .04}{C_L^{3/2}\ S^{1/4}},\ \text{as before}$$

The illustrative problem may now be attacked anew by this method.

$$\frac{62{,}100\ (10\,P)^5}{K^6\ V^3} = .0055.$$

Section		$\frac{(C_D + .04)^2}{C_L^3}$	$\frac{C_L}{C_D + .04}$	A	Min. $\frac{C_D + .04}{C_L^{3/2}\,S^{1/4}}$	
U.S.A.	5	.281	3.71	185	.0300......	2
	15	.302	3.79	212	.0303......	4
	16	.308	3.81	220	.0336	
	17	.304	3.80	215	.0315	
	21	.302	3.79	213	.0372	
	27	.286	3.72	190	.0298......	1
U.S.A.T.S.	5	.275	3.68	175	.0311......	6
	10	.250	3.56	145	.0310......	5
	13	.266	3.64	166	.0317	
R.A.F.	6	.286	3.72	190	.0318	
	15	.305	3.81	217	.0321	
Göttingen	387	.268	3.64	167	.0301......	3

The order of merit of the best sections is somewhat different from that determined by the first method, although four of the sections appear among the best six in both tabulations. Some judgment must be used in deciding which table to employ, the choice depending on the nature of the structure and the extent to which parasite resistance can be reduced when the wing section is thickened. Furthermore, thin sections with high minimum drag coefficients, such as the U.S.A. 5, should be viewed with suspicion when they give very much better relative results by the second method than by the first, as the proportional reduction of total parasite resistance in changing from the U.S.A. 15 to the U.S.A. 5, for example, would not be as great as the reduction of area.

The type of problem just solved is the most important one possible in a high altitude pursuit aeroplane. It appears clear that among the twelve sections considered, the best suited for use on such an aeroplane from the standpoint of performance alone is the U.S.A. 27, with the Göttingen 387, U.S.A. 15, and U.S.A. 5 following in that order.

F. Choice of Wing Section for Maximum Radius of Action.

Again supposing the propeller to be working at its maximum efficiency, problem of radius of action is one merely of minimum resistance, or, in other words, of maximum L/D of the aeroplane. Since for a fixed efficiency of propeller and power plant, a definite proportion of the heat units in the fuel reappear as useful work of propulsion, and since this useful work is equal to the product of resistance by distance flown, the distance possible with a given weight of fuel is obviously inversely proportional to the resistance.

(*Concluded on page* 451)

NAVAL and MILITARY AERONAUTICS

Bolling Memorial Unveiled

Greenwich, Conn.—The statue of Col. Raynal Cawthorne Bolling, the first high ranking American officer killed during the World War, was unveiled January 7th on the Havemeyer School grounds in the presence of several hundred persons, including distinguished men in public life. The statue was unveiled by Raynal C. Bolling, Jr., Col. Bolling's son.

The statue is seven feet high. It is the work of Edward Clark Potter of Greenwich. The bronze work on the figure was done by Tiffany & Co. The statue was first placed in position last October.

After the unveiling exercises were held in the Havemeyer Auditorium, Gen. Pershing, an intimate friend of Col. Bolling's, was invited to give an address, but was unable to attend. Gen. Mason M. Patrick, head of the United States Air Service; Gov. Lake of Connecticut, and Dr. George E. Vincent, head of the Rockefeller Foundation, were the speakers.

Gen. Patrick, associated with Col. Bolling during the war, paid a high tribute to Col. Bolling's soldierly devotion to duty, his work in the Air Service, and said the Government's largest training school for fliers had been the direct result of his labors in the development of the air wing of the army.

Gov. Lake's address was concerned with the great influence for good such a life as Col. Bolling's had upon the nation, and Dr. Vincent, for years Bolling's neighbor at Greenwich, told of the soldier's beneficial influence on the community.

Col. Bolling was sent to France soon after the United States declared war to inspect aeroplanes which were to be bought by the American Government. In the discharge of this duty he was killed by a German bullet at Amiens, March 26, 1918. He was decorated with the Distinguished Service Medal. He was general solicitor of the law department of the New York office of the United States Steel Corporation and a member of several clubs in and near New York.

New Operations Office at Post Field

A new operations office, located on the flying field, has just been completed at Post Field, Fort Sill, Okla., as the first step in an improvement program that promises to make this station one of the best appearing fields in the country. In addition to housing the office and equipment of the Operations Department, a lounge for pilots is provided. Comfortable seats, pictures, and flying and other publications make this an attractive gathering place. Work has already begun on an ornamental gateway to the field. The entrance is being widened and will be marked by two large stone pylons, each surmounted by an electric light. The painting of buildings is also under way.

Type D Airship Arrives at Ross Field

The long hoped for "D" type airship arrived at Ross Field on December 6th and is now under the care of Lieut. Shoptaw, who will supervise the preparation of the airship for flights. Some work must be done to realign the car and put it in first class shape. As soon as the new steel hangars are completed the ship will be inflated and put in the air. The concrete standards are all laid and set, everything being ready for the erection of the steel structure, which is expected to arrive shortly from the East.

Test of Flotation Gear on a De Haviland Plane

A test of the merits of a flotation gear installed on a DeHaviland 4B plane under the direction of 1st Lieut. F. D. Hackett, Air Service, engineering officer at Crissy Field, Presidio of San Francisco, Calif., was made at that station on the afternoon of December 9th. The plane was ready for the test at the scheduled time, Photographic Section No. 15 being present for the purpose of securing suitable pictures of the event, also many interested observers. Major George H. Brett, commanding officer of Crissy Field, in company with Major H. H. Arnold, 9th Corps Area Air Officer, gave the signal, and Lieut. Hackett as pilot, with Master Sergeant Alfred Bernhard as passenger, took off amid the well wishes for a successful trial. After circling the field at an altitude of about 1,000 feet, Lieut. Hackett pulled the throttle and nosed her down, while movie men present cranked their cameras. Prior to the take off, a boat manned by Crissy field men put out for the bay and stayed by for the landing of the plane. Within an hour and a half after the successful landing, the Crissy field men had the plane back in the hangar and were preparing it for another like flight. Much was gained from this flight, as it certainly demonstrated that the floatation gear will well serve its purpose and should be installed in all ships flying out of Crissy Field which work with the Coast Artillery, as their missions always carry them well outside of a safe gliding distance to land.

Two Naval Aviators Killed at Pensacola

Pensacola.—Lieuts. Frank Sloman, of Oakland, Cal., and Elton C. Herseman, of Weston, W. Va., aviators from the naval air station here, were killed Jan. 3 when their aeroplane went into a nose dive at an altitude of 1,000 feet and crashed off Fort Barrancas wharf.

Sloman was acting as instructor and Herseman was making his first flight at the station. The former, who was 28, is survived by a widow and ten-months-old baby. Herseman is survived by his father, W. S. Herseman, of Weston, W. Va.

Agree on Aeroplane Carriers

At the Naval Committee session of the Disarmament Conference, agreement was reached on the ratio of aeroplane carriers. The ratio of 5-5-3-2-2 was adopted for the five powers, which means 135,000 tons for the United States, 135,000 tons for Great Britain, 81,000 tons for Japan, 60,000 tons for France and 60,000 tons for Italy.

Accident at Arcadia

Arcadia, Fla.—Lieutenants Samuel H. Davis, of San Antonio, Texas, and William G. Sinclair, of Augusta, Ark., were instantly killed Dec. 28 when their aeroplane went into a tail spin about five miles from here.

The officers were attempting to land and were but a few feet from the ground, spectators said, when the fatal crash occurred. Both bodies were badly burned.

The Lieutenants were stationed at the Carlstrom Army Aviation Field.

Port Newark as Aerial Terminal

Definite proposals for the construction in Port Newark of a great airline terminal which may send passenger dirigibles to Europe are to be made in the near future.

Tentative proposals for the erection of a mammoth air depot and aircraft manufacturing center have already been made to the city officials of Newark and City Commissioner Raymond now has these under advisement. According to the plans, which are yet only in nebulous form, it is proposed not only to establish a dirigible line to take passengers from here to European ports and back, but also for air transportation to various parts of this country.

The man most interested, it is said, in the development of this ambitious plan is Paul Witteman, who is well known as an aeroplane expert, having designed a 'plane especially for European flights. Prominent New York financiers are said to be associated with him in the carrying out of the project. They selected Newark, it is stated, after looking over a great many sites, because it affords excellent facilities for the transfer of passengers and freight. Mr. Witteman made a special visit to Washington to confer with government experts about the project.

Chief Engineer James W. Costello, of the department of streets and public improvements of Newark, said that an indefinite proposal to build the air terminal had been made to the city, but that a conference to take up the matter more fully would be held within the next few days.

Mr. Witteman, it is stated, has notified Commissioner Raymond that the proposed airline plant would cover about 330 acres on the water front.

The service between here and Europe, it is declared, would be for passengers at first, but it was also said that not only passengers but freight would be handled in the airlines to points in this country.

FOREIGN NEWS

Fokkers in Spain

The Spanish Air Traffic Company of Madrid has bought two Fokker aeroplanes of the latest type. These will be put into regular service on an air line between Sevilla, Spain, and El Araish (Larache), Morocco. The distance between these points is 170 miles and includes the crossing of the Strait of Gibraltar. This line, which also carries Spanish mails, was recently opened with much ceremony, including a blessing of the machines by the Bishop of Sevilla.

Paris Aerial Police

Aerial police are at last an accomplished fact—on paper at any rate. Headquarters has just been established at Le Bourget, the aviation ground outside of Paris, whence mails and passengers are forwarded daily to most European capitals. It will have the same personnel as other police stations with the addition that all members will be certified flyers.

Their duties will include regulating air traffic and ultimately to be ready for chasing crooks who leave the city in automobiles. One of the duties at the beginning will be the taking of aerial photographs every day of various streets and boulevards in Paris during the crowded hours to help efforts to solve the traffic problem.

The police authorities insist that the photographic assignment is only temporary, as the real purpose of the new organization will be an actual air police force, as it is now authoritatively considered that in the next few years the air traffic will be large enough to require controlling in passing over the city.

British Speed Record

Over the speed course at Martlesham, England, on December 19th Mr. J. H. James established a British record by flying at an average speed of 196.4 m.p.h. in the Mars I, a product of the Gloucestershire Aircraft Company. The previous British speed record was held by James's friend and partner, Mr. Tait-Cox, flying a British Nieuport "Goshawk," whose average speed was 166.5 m.p.h. Both machines were designed by Mr. H. P. Folland, now chief engineer and designer of the Gloucestershire Aircraft Company of Cheltenham.

Over the flying kilometer James managed to beat the previous world's speed record, held by Sadi Lecointe with a speed of 206 m.p.h., by flying at the tremendous speed of 212 m.p.h. The report of the observers still has to be considered by the Royal Aero Club, and it will probably be some little time before the flight is homologated as a world's record. In the meantime we congratulate the Gloucestershire Aircraft Company, Mr. Folland and Mr. James on their wonderful achievement, as well as Messrs. Napiers, who have thus added another victory to the many already won by their famous "Lion" engine. It is a matter of the greatest importance to the prestige of British aviation that such a splendid performance should have been put up by an all-British machine, and it cannot fail to be of benefit to the aviation industry generally, which thus owes a debt of gratitude to the Gloucestershire Aircraft Company for spending the money on producing such a wonderful machine.

French Government and Aerial Budget

Last week the votes for the Air Budget were passed by the French Chamber, the chief items being subsidies, 46,389,000 frs.; aerodromes, 36,690,000 frs.; reserve raining, 3,345,000 frs.; specific work and expenses, 86,405,000 frs. Curiously the Chamber of Deputies so far has not renewed the credits for the Air Attachés in London, Washington, Rome and Peking.

Cairo and Baghdad Air Mail

There is a steady growth in the use of the Cairo-Baghdad air mail service by the public. On October 13th, last, the mail only contained 57 letters. On November 17th the number was 172. On December 1st there were 354 letters. The average time of transmission by ordinary mail from London is 27 days. The air mails dispatched from London during the past two months have reached Baghdad on the average in 12 days, and on three occasions out of five in 10 days or less.

Prize Court Award to Air Pilots

In the Prize Court on December 13th a bounty of £350 was awarded by the President for the destruction of the Turkish destroyer "Yardigar-I-Milet" by the British aeroplane "3124." According to the affidavit of Flight-Commander McClelland, on July 9, 1917, he was on board the aeroplane, which was making a raid on the "Goehen" at Constantinople. He was accompanied by Flight-Commander K. S. Savory, D.S.O., Royal Air Force, the senior officer on board, who is now in West Africa, and Lieut. P. T. Rawlings, Royal Naval Volunteer Reserve. From a height of 800 feet they dropped bombs on enemy submarines and destroyers lying close to the harbor wall. As a result, the Turkish destroyer in question was sunk and destroyed. Seventy persons were believed to be on board.

The British Air Conference

The success which attended the first Air Conference which was held in London last year has led to the decision to hold a second conference at the Guildhall in February next, under the auspices of the Air Ministry. At the last Conference service questions occupied a good deal of attention, but it has been decided that the February gathering will be concerned mainly with the development of commercial aerial transport. All aspects of this question will be discussed, and it is an advantage that Lord Weir has agreed to preside over the technical sessions. Invitations to the Conference are being issued to all those interested in the development of air transport, and arrangements are being made for demonstrations by aircraft and for a visit to the Croydon aerodrome for an inspection of as many types of machines as can be gotten together for exhibition purposes.

When the giant air liner, "City of London," recently left the London Air Station for Paris, a complete aeroplane engine was among the cargo carried.

The French in Portugal

The French company, Transaerienne de Tourisme et Messageries, is making overtures to the Portuguese Government for valuable concessions in Portugal and the islands and also in Portuguese Africa. American Minister Thomas H. Birch states that the company proposes a mail and passenger service for Lisbon, Paris being the starting point. Free transportation of Portuguese mail and the relinquishment of air material to Portugual in case of war are some of the inducements offered by the company.

British Guiana Air Mail

The air mail service, maintained with the assistance of the French Government up the Marowyne River, which is the boundary between French and Dutch Guiana, has been carried on with considerable difficulty, according to reports received from travelers. It is said that the engines are much affected by the moist climate, and that the variable depth of rivers renders a landing on their surface very dangerous because of concealed rocks which are often but a few inches below the surface of the water. This latter difficulty is intensified by the fact that the water is very often covered with mist, which prevents careful observation before landing.

The Bermuda and West Atlantic Aviation Company has proposed to the Government of British Guiana to make a demonstration and survey for aerial transportation—an offer probably now accepted.

Swedish Service Suspended '

The bi-weekly air mail service between Stockholm and Reval, run by the Svenska Lufttrafik Aktieholaget during the months of July, August and September, was suspended on October 1st. The American Minister, Ira N. Morris, at Stockholm, reports that from a technical point of view the service was very successful, but the infrequency of passengers made it a nonpaying enterprise.

The Postmaster General paid a subsidy for the carrying of mail, but this was not large enough to cover even mere working expenses. Of 21 round trips promised, 19 were carried out. The distance was covered in 2 hours and 20 minutes, on an average, while the steamers take 24 hours. Only 21 passengers were carried altogether, and 800 kilos of mail were transported from Stockholm to Reval.

This service has shown that aerial transportation over the Baltic is not only practicable but is likely to fill a real need when Russia again revives.

Argentine Progress

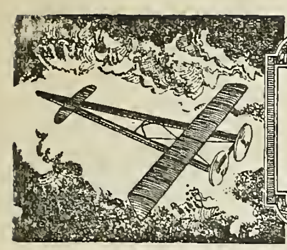
Another indication of the success which is attending the efforts of Colonel Mosconi, Chief of the Army Aviation Service, and of the Argentine Patriotic League and the Aero Club of Argentina in arousing enthusiasm in aviation matters, is the presentation of a Bristol 300-h.p. Hispano Suiza to the Military aviation school at El Palomar by the city of Avellaneda. There seems to be but little doubt that the precise and practical plans of Colonel Mosconi for air routes, landing places, military-civil air station, etc., and the calls on the Provincial governments and cities, and on wealthy citizens for cooperation, are bearing fruit.

An Imperial Airship Service

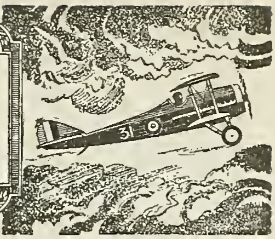
A good deal has appeared in the daily newspapers recently on the subject of the projected—we call it projected, though suggested would probably be the better term—Imperial airship service. If we were to take seriously all we have read during the past week or ten days, we should begin to think that we are really on the eve of seeing such a service actually in being. But when we come to dissect all that has been said and written, we really cannot see that we have travelled much farther along the road to the consummation of what is the desire of all who have the future of commercial aviation at heart. Let us see to what it all amounts.

At the Imperial Conference of Dominion Prime Minsters it was suggested that an airship service for linking up the Empire should be established. Estimates were submitted which showed that an outlay of about £1,339,000 would be necessary to carry out an experimental service over a period of two years. Later it was thought that it might be done at a cost of a million pounds, and the proposal was put forward that of this the Mother Country should contribute £325,000, Australia and India £250,000 each, Africa £100,000, and New Zealand £75,000. Up to the present the only concrete offer is that of Australia, but it is said that contingent upon the other contributions being forthcoming a financial group is willing to find a further sum of 2½ millions to start a regular service to Egypt, South Africa, India, Australia and New Zealand, such service—which is to be fortnightly—not to be started until the expiration of a two years' experimental period. There seems to be a further contingent stipulation that the British and Dominion Governments must subsidise the service to the extent of £500,000 annually for a term of years. This subsidy, it is proposed, should be provided as to £250,000 by Great Britain and a further equal sum by the Dominions. Mr. Ashholt, the Agent-General for Tasmania, who has worked hard and unceasingly in favor of the scheme, says that if all these conditions are fulfilled he can get all the money he wants for the service. He is optimistic enough to think that this country will be willing to find any reasonable balance of the amount required to complete the initial £1,000,000 after definite replies have been received from the Dominion Governments.

Well, it may be so, but we confess that when we regard the past and present policy of the Government towards commercial aviation, whether concerning aeroplane or airship, we are not encouraged to hope too much. Naturally, we hope as sincerely as any that the British Government will agree to find any reasonable sum of money to assist in opening up a service which cannot but be of inestimable value to Empire communications, but whether the hope has any justification in fact we frankly do not know. At any rate, it is cheering to know that the scheme for an Empire airship service is not as dead as we had supposed it to be, though we do think that those who have been telling us that the service is likely to be inaugurated with the British airships which are at present "rotting in their sheds" are unduly sanguine. It is certain that the rotting process has not gone too far to be retrieved. Or that the dispersal of *personnel* and stores has not progressed to a point at which it would be true to say that there remains now no nucleus even of a practical service. We should really like to hear from the Air Ministry on this particular point.—*Flight.*



ELEMENTARY AERONAUTICS *and* MODEL NOTES



The General Design of Model Aeroplanes

By Ellis C. Cook.

Types of Models

PRACTICALLY all model aeroplanes come within two classifications:—

1. The type commonly called the "Flying Stick," of which the model may be either a tractor or a pusher, and have either one or two propellers. This type of model may be further subdivided into three groups:

A. Hand launched
B. Rise-off-ground (Risers)
C. Rise-off-water (Hydros)

2. The "Scale" model fashioned after some successful motor-driven aeroplane. In this class would also be the "Fuselage" models with no large sized prototype. Since all of this class of models have landing gears, there would be no type classification for hand-launched machines, so there would remain only the two groups:

A. Rise-off-ground
B. Rise-off-water

These subdivisions may be further amplified with the distinction between rubber and power-driven machines, monoplanes and biplanes, single or double propellers, or many other variables. My article will be confined to the rubber-driven type and especially to the "Flying Stick" type.

Purposes

The purposes for which the model is designed and built usually come under the following heads:

A. Duration of flight
B. Distance of flight
C. Quality of flight
D. Altitude attained
E. Quick climbing
F. Workmanship

These heads are arranged approximately in their order of importance in the minds of the average model builder. Of course there may be a model built with nothing else in view except accurate construction, but I am considering only the flying models. All of the above qualities are of importance in the better class of models—the ones which are the record holders—and it must not be assumed that good duration or distance may be obtained with a model which behaves badly in the air or which habitually flies but a few feet from the ground.

I propose to go into as much detail as space allows, into the practices of the Illinois Model Aero Club during the past five or six years, in building models which at present stand out as foremost in the world.

Duration of Flight

For the first year or two of this club's existence, all meets centered upon distance flown and duration was but incidental. At present, and for some time past, duration has been the chief quality for which the builder has designed his machine.

Some years ago, while attempting to improve my machines from a duration standpoint, I evolved an empirical formula for the duration of flight with rubber power. It is:

$$\text{Duration (seconds)} = \frac{\text{K x (weight of rubber) x (glide)}}{\text{(weight of model) x (speed)}}$$

Where "Glide" is expressed as, say 6 for a 6:1 ratio. The weights must all be expressed in ounces and the speed in feet per second. The glide might better be called the resistance factor for it is the ratio between the weight and the resistance. The constant K was found by a comparison of several different models, to be approximately 800 for twin propeller pushers. For the tractor type I would expect it to be less on account of the added resistance due to the slipstream. I have calculated this constant from the official records and characteristics of four models. Of course this formula will only hold good for flights which are not the results of abnormal conditions, such as up-currents of wind, and the constant given is that corresponding to best performance due to maximum efficiency of the model.

One of the most important factors in duration flying is the propeller design, in my opinion, and experimental propellers of several designs should be tried out on each new machine.

The method which I have long used for propeller design consists of the following, essentially:

1. From the weight of the machine and wing area calculate the model's speed from the equation $V = 8\sqrt{\text{loading.}}$

2. Experimentally determine the glide. (With rubber on but propellers off.)

3. Calculate maximum duration by the formula given above.

4. Calculate the number of turns which may be given the rubber by the formula

$$\text{number of winds} = 4.75 \text{ x L} \sqrt{\frac{\text{L}}{\text{Wt.}}}$$

where L is length of rubber between hooks. Wt. is weight of rubber in ounces.

5. From the duration and number of winds allowed, the revolutions per second of the propellers can be figured.

6. Having the R.P.S. and the model's flying speed, the actual pitch may be found by dividing the flying speed by the R.P.S. This pitch is in feet and is only the actual pitch realized. I have found that this actual pitch realized is only about 60% of the theoretical pitch for the usual type of true-screw propeller, and in order to lay out the propeller from the design data given, it is necessary to give them a measured pitch of ten sixths of that which was calculated.

Having the pitch and the R.P.S. required, it is now necessary to give the proper blade width to satisfy the R.P.S. conditions. This is difficult to do and should be done experimentally. This can best be done by making the propellers of the correct pitch but with a blade width which keeps the speed below that required, and then cutting down the width until the speed is satisfactory.

Distance of Flight

The distance which a model will cover in calm air can be found by the product of the flying speed and the duration, each of which has been calculated. Actually, practically all distance meets are held with some wind blowing and this adds considerably when the wind is strong. Were all distances measured on a calm wind basis, the maximum would probably be in the neighborhood of 2000 feet, whereas I have seen two flights of over 5000 feet measured and quite a number better than 4000 feet. Obviously the difference between 5000 and 2000 feet must be attributed to the action of the wind, and in designing a machine to take advantage of the wind it is necessary to build it somewhat stouter than a duration machine is made.

The wing must be stronger and the model should be a trifle overpowered in order to be able to stand the wind gusts without losing altitude. With these exceptions a distance machine does not differ from one designed purely for duration.

Quality of Flight

It goes without saying that all models must be stable under all conditions and this stability is usually attained by means of longitudinal and lateral dihedral angles. The front surface is given an angle of incidence greater than that of the rear surface. Usually the rear surface has no angle with respect to the motor base, while the front surface is given an angle of three to ten degrees. A lateral dihedral within the same range is generally given to the main plane, while the elevator, in the case of a pusher machine, may be given a much greater angle. In the case of distance machines the elevator may have as great an angle as 45 degrees. This high dihedral aids in controlling the machine on a straight flight.

Tractor models need a greater dihedral angle than do the twin pusher models. A high fin in combination with a large dihedral gives good stability to a tractor. A negative dihedral in the tail plane of a tractor seems to improve the wind-fighting qualities of this type of model also.

The proportioning of the main plane and the elevator of a pusher can be carried out between rather wide limits. A main plane area four to six times as large as the elevator gives very good results. For rise-off-water machines, the elevator should be somewhat greater in area in proportion to the main plane than for the hand-launched type in order to counteract the disturbing influence of the floats. A ratio of four to one gives satisfaction for this type of model.

(To be concluded in next week's issue of Aerial Age.)

A-E-R-O-N-I-T-I-S

R. O. T. C.

For a below stude means—Read Over Ten Chapters.
For a tired business man—Run Over To Club.
For a football player—Rush On Through Center.
For an upper-classman—Rare Over The Co-Eds.
For the dogs around Penn State—Roam Over The Campus.
For your roomie—Roll Over There, Charlie.
For the Co-Eds—Rise, Obey Thy Cupid.

To You

Slim dainty nothingness!
Enhanced by none but
Thine own fair grace and beauty,
To thee I lift mine eyes at break of day
Thy clinging caress feel,
Thy lingering thouch of softness,
When I surround myself in thee—
My B—
My B. V. D.

The Wail of A Lost Soul

O woe is me! A little flea,
Has in my boudoir recently,
Raised up a fighting family;
And now at night I scratch and bite,
And suffer while those armies fight;
I cannot eat; I cannot sleep;
I feel them jump; I feel them creep;
O save me from my punishment,
Please teach those fleas disarmament!

Quite So

Young Lady (to small boy)—"Little boy, does your father know that you smoke cigarettes?"

Small Boy—"Naw! No mor'en yers knows you talk to strange gennemens on de street widout the proper intreduction."—*Virginia Reel.*

A handsome young feller named Smith
Once asked a sweet maid for a kith,
She replied with a nod,
Then lithped, "O my God
I wonder if Heaven's like thith."—*Puppet.*

She—"Do you know I find it so much colder out here than it was back home? There I wore light garments all winter, but since moving here I have had to put on heavier clothing. I'm from Oregon, you know."

He (with a polite show of interest)—"Is that so? I'm from Missouri."—*Burr.*

He—"What do you call that part of your skirt under the lace?"

She—"Oh, that's a slip."

He (blushing)—"Oh, I beg your pardon."—*Ghost.*

There was a young woman from Detroit
Who at dancing was very adroit
But one day she slipped
And—oh! something ripped!
Thank god! 'Twas the hem of her skoit.

A Prescription

The thirsty soul which craveth drink
Should saturate itself with think.
Just cogitate upon this please,
You find a nip is in the breeze.
Of wind or winter, take your pick,
For either of them has a kick.
Mix well, and with them, while you snooze.

Biting the grass roots
Is young Jack Spry
He raced with an engine—
The race was a tie.—*Missouri Showme.*

Inquisitive Old Lady—"Now do tell me about your first success."

Wearied Young Author—"Well, you see, madam, I was crossing the ocean last summer and was a contributor to the Atlantic."—*Lampoon.*

Our Worst Enemy

Your low-stunt stuff is all the bunk,
Where mishap turns good planes to junk.
Through molding skulls, from out the past,
Hasbens look on—you are the ass!

For watching eyes you "climb the 'hack,"
Your failing motor slides you back.
The "Reaper" waits beyond that zoom:
The chandelle spells an early doom.

You try a down-wind turn, just off the ground,
"He crossed controls," they tell the town.
You used left rudder—instead of right—
From there the angels marked your "line of flight."

Now to give the girls a regular treat!
For low-turned loops are just your "meat."
Your moves were right, you made the try!
But boobs like you should use more sky.

Or perhaps you'll try a spiral, tight!
To show the gulls what's meant by "flight."
Yol were good and piled her right up on the "T,"
Your "spiral" spun you to Eternity.

And thus it is, the ranks must grow
Of those who don't, but think they know.
They break fool necks and hurt the game,
They class us all as nuts who may be sane.

That low-stunt stuff is obsolete,
You buck a game that can't be beat!
The flower of fooldom watch you from beyond,
Where tombstones bar their sky at dawn.

—*A. A. C.*

Adventure

I've been eaten by sharks in Calcutta.
I've been eaten by men in Fiji,
I've been buried alive in Sahara,
And drowned in the Caspian Sea.
I've been flayed to death in Kamchatka,
I've been burned at the stake once or twice,
And when I was up in Alaska
I was frozen to death in the ice.
I've been torn by both tiger and lion,
I've been smothered to death by my wife,
And, pray, do not think I am lyin'—
For I lead an adventurous life.

—*R. N.*

There once was a foolish young goat
Who ate all that a verse-librest wrote.
He got indigestion,
Acute without question,
And moaned, "Now I see I'm the goat."

—*The Owl.*

"Yes, business is looking up here."
"How come?"
"It's flat on its back and can't look any other way."

—*Harvard Magazine.*

Tommy asked his sweetie, pretty Nancy Beck,
What she wanted for her birthday.
"Oh! Tommy darlin', somethin' for my neck."
Of course a pearl necklace was her hope,
But he bought her a cake of soap.

—*Jed.*

(*Continued from page* 446)

If the coefficient of total resistance in terms of wing area be taken, as before, as $C_D + .04$, (this assumes the equivalent flat-plate area to be 3.1% of the wing area), the total resistance of the aeroplane is:

$$\frac{\dfrac{W}{C_L}}{C_D + .04}$$

This is obviously a minimum for minimum area, and the radius of action would therefore be increased by clipping the wings if the amount of fuel carried remained constant. If, on the other hand, the proportion of fuel weight to total weight is constant the radius of action is independent of weight and area. In actual fact the proportion of weight carried as fuel increases with increasing area, and the radius of action is therefore actually largest when the area is largest. Whatever area may be selected, however, the best wing section is the one giving the largest maximum value of $\dfrac{C_L}{C_D + .04}$ a function which is tabulated below for a number of sections.

It is obvious that the requirements for covering a given distance with a minimum fuel expense are the same as those for covering the maximum distance with a given weight of fuel, and the same criterion therefore serves as a measure of commercial economy as well as of radius of action.

Name		Max. $\dfrac{C_L}{C_D + .04}$
U.S.A.	5	8.74
	15	8.55
	16	8.26
	17	8.45
	21	8.06
	27	8.78
U.S.A.T.S.	5	8.02
	10	8.37
	13	8.09
R.A.F.	6	8.41
	15	8.11
Göttingen	387	8.38

G. Choice of a Wing Section for Maximum Duration.

Flights of very long duration are seldom of great practical value in themselves, but the making of a new duration record always attracts enough interest and serves as a spectacular enough demonstration so that the requirements for securing maximum duration of flight must not be overlooked entirely.

If it be again assumed that the propeller and power plant efficiency are constant the securing of a maximum duration is simply a matter of cutting down the minimum power required, as the weight of fuel which the aeroplane can lift represents a certain definite number of horsepower hours, and any reduction in the power makes possible an increase of the number of hours. It is too obvious to require proof that the possible duration increases with increase of area, practically the only limit to the possible gains in this way being the drop in propeller efficiency as the speed of flight falls off with increasing area.

It has already been shown that the minimum horsepower required is secured with that wing section which gives the largest maximum value of $\dfrac{C_L^{3/2}}{C_D + .04}$. The conditions for maximum duration are closely akin to those for maximum climb.

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3. Have a record of airplanes and pilots available throughout the country in times of emergency.

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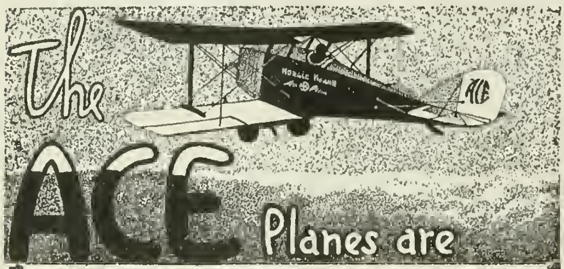

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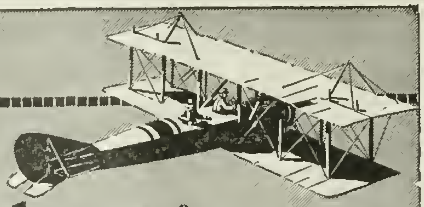

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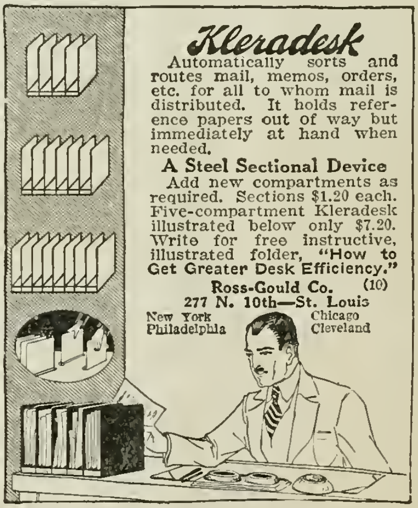

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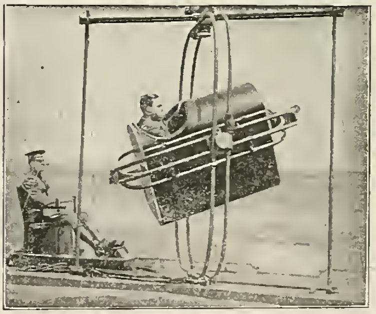

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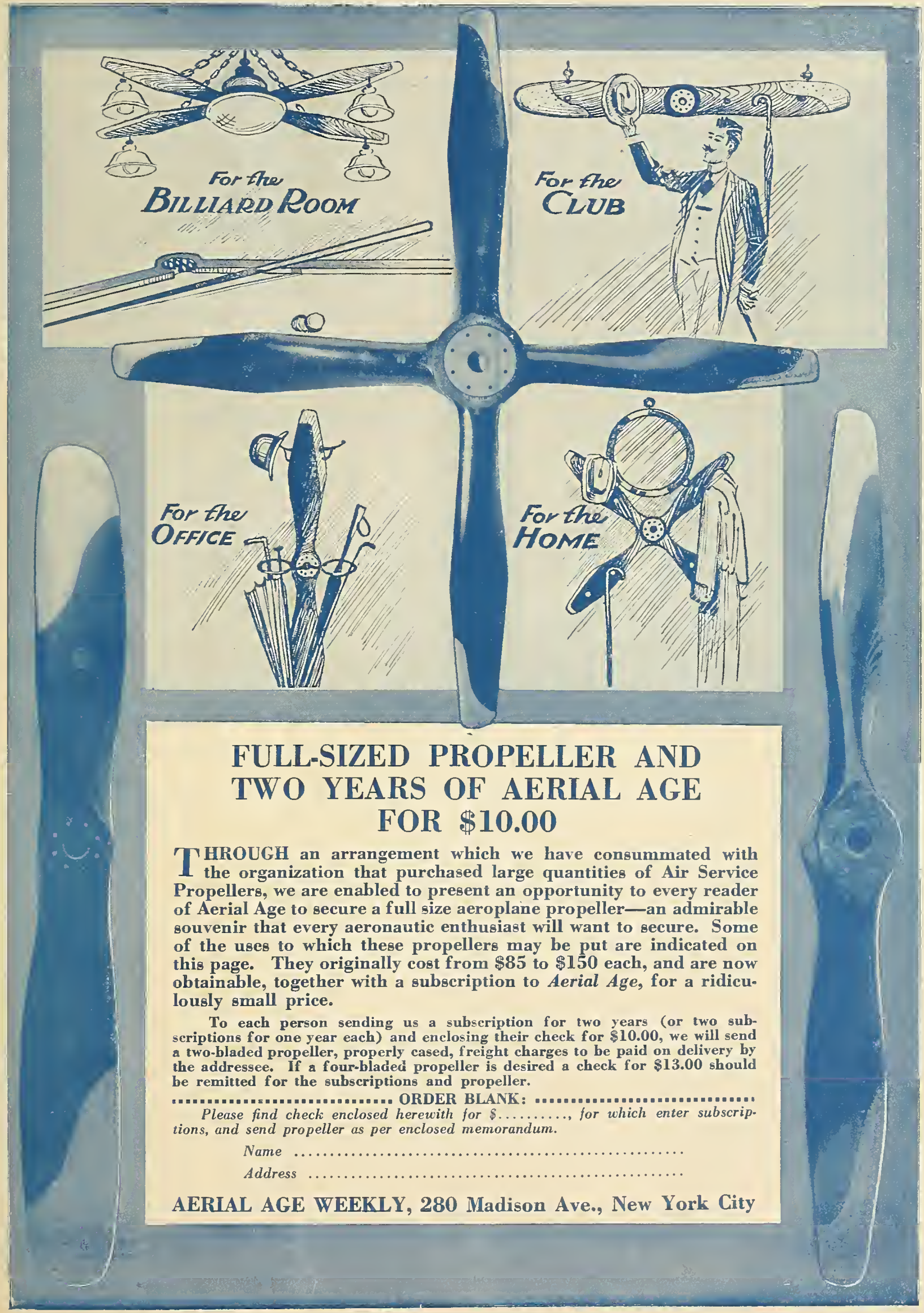

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To each person sending us a subscription for two years (or two subscriptions for one year each) and enclosing their check for $10.00, we will send a two-bladed propeller, properly cased, freight charges to be paid on delivery by the addressee. If a four-bladed propeller is desired a check for $13.00 should be remitted for the subscriptions and propeller.

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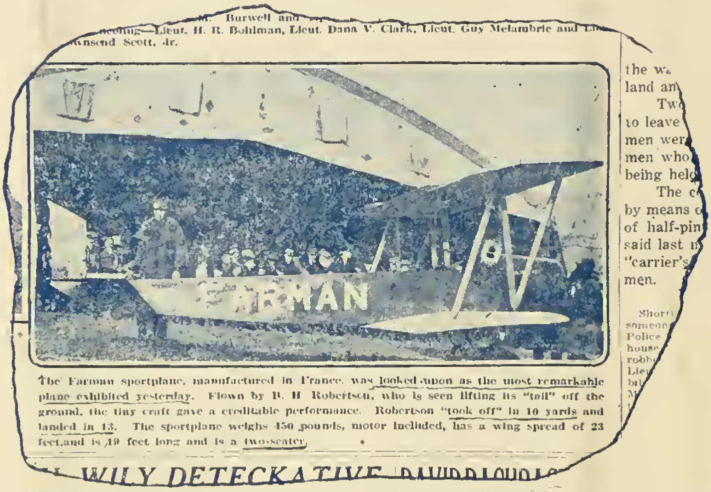
"THE MARVEL OF THE AIR"

PROVES ITS TITLE WHEREVER IT FLIES

AT BALTIMORE, MD. 2d Aero Exhibit—Baltimore Flying Club Dec. 10th.

Baltimore "American"—Dec. 11th.



Burwell and

—Lieut. H. R. Bohlman, Lieut. Dana V. Clark, Lieut. Guy Melambrie and

nsend Scott, Jr.

The Farman sportplane, manufactured in France, was looked upon as the most remarkable plane exhibited yesterday. Flown by D. H. Robertson, who is seen lifting its "tail" off the ground, the tiny craft gave a creditable performance. Robertson "took off" in 10 yards and landed in 13. The sportplane weighs 450 pounds, motor included, has a wing spread of 23 feet, and is 18 feet long and is a two-seater.

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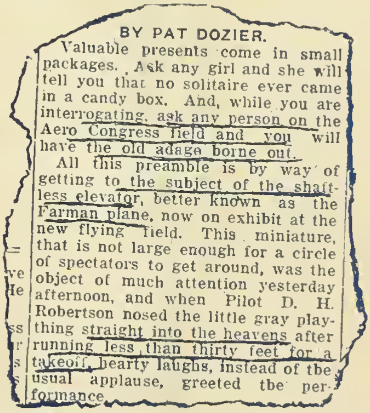
WILY DETECKATIVE

At BRUSSELS, BELGIUM—Sept. 3d-4th. Aero Club of Belgium Flying Meet. Winner of International Touring Airplane Contest with a 20% higher score than its nearest competitor in a field including the best French, English, Italian, Dutch, etc., Touring Airplanes.

At OMAHA, NEBR. International Aero Congress Meeting—Nov. 4th-8th.

Omaha "World Herald"—Nov. 5th.

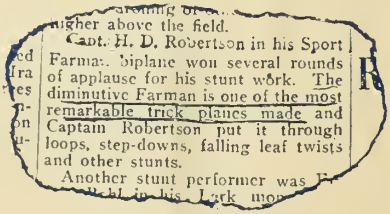


BY PAT DOZIER.

Valuable presents come in small packages. Ask any girl and she will tell you that no solitaire ever came in a candy box. And, while you are interrogating, ask any person on the Aero Congress field and you will have the old adage borne out.

All this preamble is by way of getting to the subject of the shaftless elevator, better known as the Farman plane, now on exhibit at the new flying field. This miniature, that is not large enough for a circle of spectators to get around, was the object of much attention yesterday afternoon, and when Pilot D. H. Robertson nosed the little gray plaything straight into the heavens after running less than thirty feet for a takeoff, hearty laughs, instead of the usual applause, greeted the performance.

Omaha "Bee"—Nov. 5th.

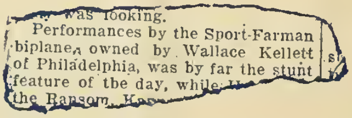


higher above the field.

Capt. H. D. Robertson in his Sport Farman biplane won several rounds of applause for his stunt work. The diminutive Farman is one of the most remarkable trick planes made and Captain Robertson put it through loops, step-downs, falling leaf twists and other stunts.

Another stunt performer was

in his Lark mon



was looking.

Performances by the Sport-Farman biplane, owned by Wallace Kellett of Philadelphia, was by far the stunt feature of the day, while

the Ransom,

Space limitations permit the printing of only a very few extracts from the many news accounts describing the wonderful performances of the Farman witnessed by government officials, aeronautical men and press representatives. Brief accounts of its flights at Etampes, France; Kansas City, Mo.; New York and Washington will appear in following numbers of "Aerial Age."

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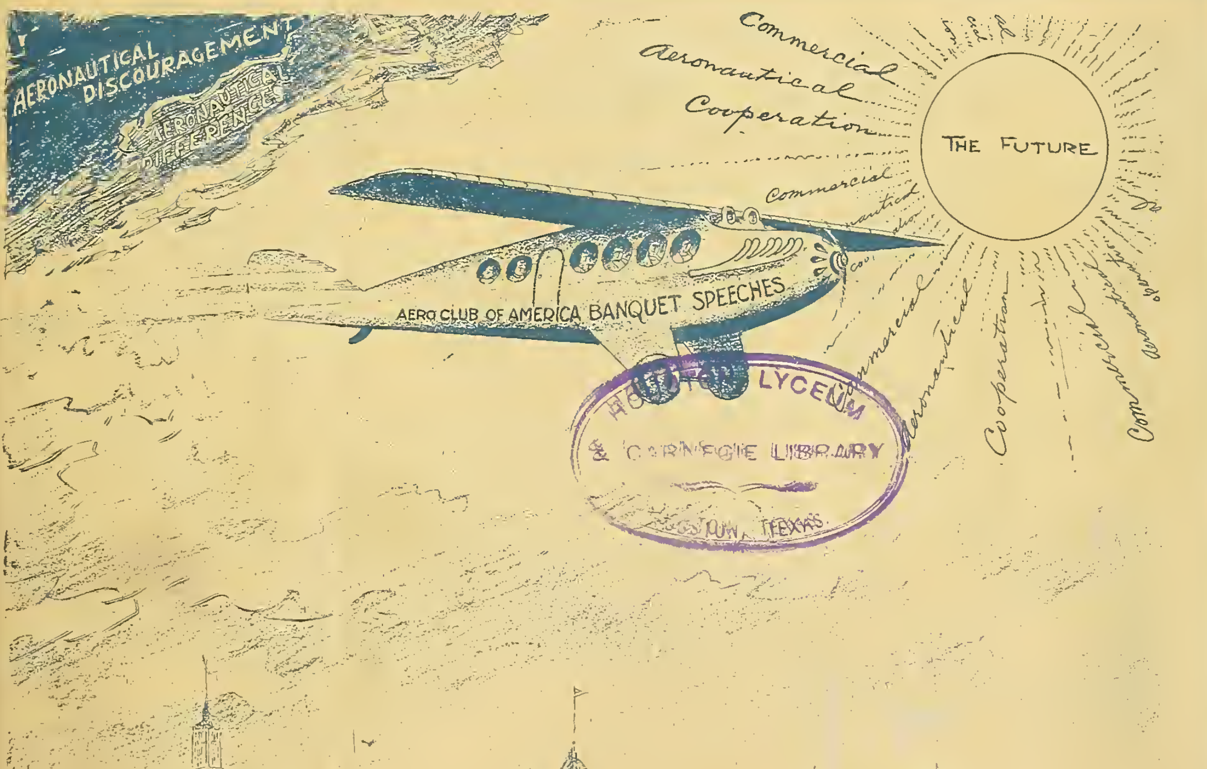
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The Nationalization of the Aero Club of America

Air Mail Service Threatened

BLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
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We invite Correspondence and to further interest are prepared to give without charge all possible information on the general aspects of Air Transportation.

January 23, 1922

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WEEKLY

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LOENING AIR YACHT"

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WRIGHT TROPHY
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Piloted by Clifford Webster
October 14, 1921

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Established on August 16, 1921 by
David H. McCulloch, formerly Commander U. S. N., in LOENING AIR YACHT

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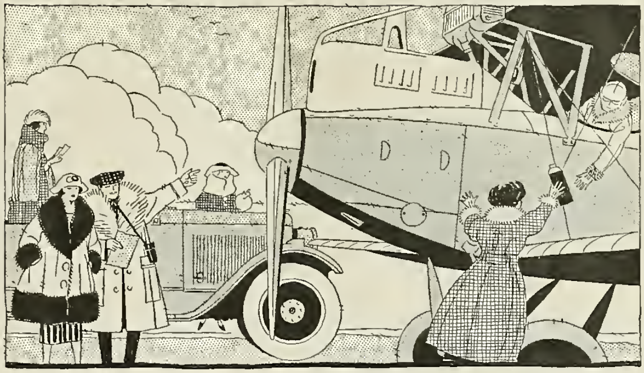

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Curtiss

The following are a few of the contributions of the Curtiss organizations to the advancement of Aviation listed by dates.

July 4, 1908 ...... Mr. Glenn H. Curtiss made the first previously announced flight in public. Flight being made at Hammondsport, New York. On the same date Mr. Curtiss won the Scientific American Trophy in open competition in America.

Aug., 1909 .... Mr. Curtiss won the Gordon Bennett International Speed Trophy at Rheims, France.

May 29, 1910 ..... Mr. Curtiss flew from Albany to New York, this being the first city to city flight ever made.

June, 1910 .... At Hammondsport, New York, Mr. Curtiss demonstrated the possibilities of bomb dropping.

Aug., 1910 .... Mr. J. A. D. McCurdy in a Curtiss plane was the first to send and receive wireless messages from an aeroplane in flight.

Jan., 1911 .... Eugene Ely in a Curtiss plane was the first to alight on and fly from the deck of a battleship.

Jan. 26, 1911 ..... Mr. Curtiss "took off" on San Diego Bay, this being the first attempt to fly from the water.

Feb. 23, 1911 .... Mr. Curtiss flew from land to water and from water to land at San Diego, California.

April, 1911 ...... U. S. Navy adopted the Curtiss aeroplane as a practical air and water craft.

June, 1911 .... Lincoln Beachey piloting a Curtiss plane was the first to fly over Niagara Falls and through the gorge.

Aug. 1, 1914 to June 30, 1919 .... During this period the Curtiss Aeroplane & Motor Corporation manufactured and shipped the following planes and motors:

PLANES		PLANES		MOTORS	
JN	**4627**	**Dirigibles**	**15**		
L Triplanes	**4**	**K boats**	**56**	**OX**	**4936**
N 9 Hydroaeroplanes	**110**	**Seaplane scouts**	**11**	**V's**	**353**
R's	**407**	**Hydroaeroplanes**	**16**	**Misc. motors**	**3**
F boats	**105**	**HS boats**	**301**		
Misc. planes	**16**	**Total Planes**	**5668**	**Total Motors**	**5292**

May 27, 1919 ..... The "Navy Curtiss 4" successfully flew across the Atlantic Ocean, leaving Rockaway Beach, Long Island, May 16, 1919, and reached Plymouth, May 31, 1919.

Sept. 18, 1919 .... Roland Rohlfs piloting the Curtiss "Wasp" set a new official world's altitude record without special plane or motor accessories, of 34,910 feet. This record was retained until 1921.

Oct. 31 to Nov. 5, 1921 .... Mr. C. S. Jones piloting a stock Curtiss C-6 Oriole won the Legion Junior Derby Race at Kansas City. Mr. Jones also won the Omaha 90 mile race in the same plane. Curtiss K-6 Orioles also took second and third prizes in this race.

Mr. Lloyd Bertaud in a Curtiss K-12 Balilla won the American Legion Free-for-all at Kansas City, Mo.

Mr. F. A. Donaldson in a Curtiss OX5 Oriole won the Omaha 95 mile race.

Mr. Bert Acosta flying the Curtiss Navy Racer won the Pulitzer Trophy Race at Omaha, Nebraska, and in so doing established a new speed record in contest flying of 176.7 miles per hour.

The Curtiss organization has designed over 200 types of planes and 25 types of motors.

CURTISS AEROPLANE & MOTOR CORPORATION

GARDEN CITY LONG ISLAND

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AERIAL AGE WEEKLY

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THE NATIONAL
TECHNICAL, ENGINEERING AND TRADE
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With which is consolidated
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The Nationalization of the Aero Club of America

THE nationalization of the Aero Club of America is being effected by embracing the plans of the National Air Association formed at the Convention held at Omaha, November 3, 1921.

The Special Committee appointed by the Board of Governors of the Aero Club of America, and the representatives of the National Air Association, have agreed upon the following plan of reorganization which only awaits the completion of legal formalities before it is put into execution.

The United States is divided into 9 Districts, corresponding to the Corps Areas of the United States Army Air Service. Two representatives will be elected in each District (Corps Area) to serve on the Board of Governors of the national body. One of these representatives will be elected Chairman of the District and becomes automatically, through this election, one of the Vice Presidents of the national body. One of these representatives must be an aviator.

Plan of Reorganization

There will be a President, 9 Vice Presidents, Board of Governors of 30; composed of 18 representing the 9 Districts (Corps Areas) and 12 elected at large.

Until elections can be legally held under this plan of reorganization, the following members of this Special Committee represent the Aero Club of America and the National Air Association: Caleb C. Bragg, Chairman, Contest Committee, Aero Club of America, New York City; Sidney D. Waldon, President, National Air Association, Detroit, Michigan.

Air Mail Service Threatened

THE Director of the Budget, Mr. Dawes, regarded the Air Mail as absolutely necessary and recommends $2,200,000 for the next fiscal year, July, 1922-July, 1923. The Sub-Committee of the House Appropriations Committee reduced that figure to $1,935,000. On January 11th, the House Appropriations Committee (Chairman Madden) entirely eliminated the Air Mail appropriation and reported the Post Office Bill to the House, on the floor of which the general Post Office Bill *is now being debated.*

If the Committee's action is sustained by the House and Senate there will be no Air Mail service in the United States after next July 1.

The Air Mail for the present fiscal year, 1921-1922, had an original appropriation of $1,250,000. which was later increased by a deficiency appropriation to $1,425,000. This has maintained the New York-San Francisco service, the only service now operated. It has a record of 89 per cent efficiency during the last year. More than 90,000,000 first class letters have been carried since the Air Mail was started, most of them across the continent. Service between the Atlantic and Pacific has been speeded up to between 48 and 60 hours, where 100 hours at least are required by all train service.

One hundred and five of the larger cities in the country have petitioned the Government to provide them with an Air Mail service.

The Air Mail planes cost practically nothing, as most of those in use have been obtained from the surplus supply of the United States Army, which otherwise would eventually have been scrapped, without use, due to deterioration through old age.

With the discontinuation of the Air Mail service, civilian, military and commercial aviation will suffer an almost irreparable loss, as the Air Mail service operating all the year round from the Atlantic to the Pacific gives:

(1) Research work embracing all phases of practical flying and a knowledge of the air conditions across the Continent during all seasons of the year (Military aviation is confined in winter to the fields in the sunny South).

(2) It maintains a trans-continental Air Highway which will be used by civilian and commercial aircraft and can be used by military aircraft in case of an emergency. The aerodromes, hangars and shop facilities of this highway would be lost to aviation without the Air mail.

(3) The Air Mail service has and is developing the best group of practical aviators in this country, flying, as they are daily, cross country under anything but impossible flying conditions. Their experience and "flying sense" will be invaluable for the training of future pilots, and their practical experience of inestimable value to the engineers and constructors.

Civilian and commercial aviation will suffer a deplorable setback if the Air Mail is abandoned. Congress realized this a year ago, when the same committee cut the Air Mail appropriation. It was partly restored.

The National Advisory Committee for Aeronautics has urged the continuation and development of the Air Mail.

Your duty is clear. Support the National Advisory Committee in supporting the Air Mail and by writing or telegraphing your representative in Congress.

THE NEWS OF THE WEEK

House Committee Drops Air Mail Funds

Washington.—With provisions for the air mail service eliminated, the annual Post Office Appropriation bill, carrying approximately $554,000,000, was favorably reported Jan. 11 by the House Appropriations Committee.

As drafted by a subcommittee the measure provided $1,935,000 for the air mail service during the fiscal year beginning next July 1. The full committee, however, in approving the bill struck out this section. The total carried in the measure is $24,707,976 less than the appropriation for the current fiscal year, and $24,735,691 less than the amount requested by the Budget Bureau.

In explaining the elimination of the air mail service item, Chairman Madden said that opposition developed among members of the committee to the appropriation on the ground that transportation of mails by air had proved expensive and not particularly efficient.

For the current fiscal year a total of $1,425,000 was appropriated for the air mail service, the only route now in operation being that between New York and San Francisco.

Holds Design of ZR-2 Caused No Undue Risk

London.—No undue risk was taken in the design of the R-38 (ZR-2), and there was no change from previous practice, as regards safety, which experience or comparison with German airships did not make permissible, according to a report of the Admiralty Committee Board, included in a statement given out by the Admiralty Jan. 10th.

The statement embodies a report of the full investigation held in accordance with the decision of the Admiralty Board after the big dirigible exploded over Hull, England, in a trial flight last August, killing more than forty officers and men of the British and American navies. This occurred just before the vessel was to have been turned over to the United States Navy.

According to the statement, the evidence showed that no modifications were made in the main structure of the R-38 to October, 1919, when responsibility for design and construction was transferred to the Air Ministry. Though alterations were made in weight, nothing was done to affect the structural strength of the ship. No important alterations in design were made later, but there were some modifications, as a result of experiments, of fins, cars and other parts of lightness, which would not affect the strength of the structure.

The Heath Universal Propeller

There is now on demonstration at the works of The American Propeller & Mfg. Co., Baltimore, Md., a universal propeller designed by Spencer Heath and now in operation on a 4,000 pound land machine under full load and power conditions. The blades of this propeller can be adjusted universally in their sockets for any angle of forward or reverse pitch while the engine is running, the power of the engine itself being used to effect the changes of pitch. A light pull or pressure on a button is all that is required to produce any change of pitch desired. When the engine is at rest the pitch may be altered or reversed by turning a small hand crank located conveniently to the operator. The machine accelerates or decelerates or travels forward or backward in response to changes of pitch. At all times and during all changes of pitch the exact position of the blades is graphically shown by an indicator on the instrument board.

The speed of the engine is automatically controlled by the indicator mechanism so as to give the correct throttle position for every possible blade position and thus prevent racing or stalling the engine by manipulation of the pitch. The engine is subject at all times, however, to manual control of the throttle which may at any time interrupt and supervene upon the automatic throttle control. The entire operating mechanism is entirely disengaged and the blades securely locked at all times except during change or adjustment of the pitch.

Offices of Foreign Air Attaches

The office of Captain de Lavergne, French air attaché in Washington, D. C., is now located at 2635 16th St. N. W., and all correspondence should be so addressed. The telephone number is Adams 2414.

The office of Lt. Col. A. Guidoni, Italian air attaché, is located in the building of the Italian embassy, 1400 New Hampshire Ave., Washington, D. C. The telephone numbers are Franklin 6617 and Main 276.

Aeronautic Legislation

The following memorandum on aeronautic legislation was issued by the Aeronautical Chamber of Commerce:

Dec. 6. House. Mr. F. C. Lanham speaks in the House relative to the flight of the C-7 inflated with helium. Accomplishment marks a new era in aviation.

Dec. 10. House. Mr. Steenerson: A bill (H. R. 9462) to encourage commercial aviation and authorizing the Postmaster General to contract for air mail service, and prescribing rates of postage thereon; to the Committee on Post Office and Post Roads.

Dec. 12. Senate. Mr. Borah: (S. Res. 188) Directing the Sec. of War to send the Senate the report of Gen. Mitchell relative to the sinking of battleships at Langley Field, filed in September, 1921. Agreed to—See under Jan. 4, 1922.

Dec. 19. House. Mr. Parrish: A bill (H. R. 9635) to provide for flying pay for officers and enlisted men of the regular army who are incapacitated by reason of injuries incurred in or by aircraft accidents; to the committee on military affairs.

Dec. 20. House. Mr. Hicks: A bill (H. R. 9657) to authorize the Sec. of Commerce to establish a bureau of civil aviation in the Dept. of Commerce, to encourage and regulate the operation of civil aircraft in interstate and foreign commerce and for other purposes; to the committee on Interstate and Foreign Commerce.

Dec. 21. Senate. Mr. Walsh: (S. Res. 200) Directing the committee on naval affairs of the Senate to investigate the transfer and examination held in connection therewith of officers of the naval air service and members of the Naval Reserve Flying Corps. Ordered to lie on rule.

Jan. 3. House. Executive communication 443. A letter from the Acting Sec. of Navy transmitting a tentative draft of a bill for the purchase of the naval aviation station at Galveston, Tex. and appropriating $18,000 for same; to the Committee on Naval Affairs.

New Air Mail Hangar at Crissy Field

Mr. Caldwell, Air Mail Superintendent, has let the contract for a new hangar at Crissy Field. Work was begun on Nov. 28, and it is expected that construction will be completed and the hangar ready for occupancy in thirty days. The hangar now used by the Air Mail Service will be turned over for the use of the Reserve Squadrons now organizing in the vicinity of San Francisco.

CALENDAR OF COMING EVENTS
under sanction of
AERO CLUB OF AMERICA

April 30th (1 or 2 days)

Spring Show and Opening Meet

Place: Curtiss Field, Mineola, L. I., N. Y.
Conducted by: Curtiss Airplane & Motor Corporation, Garden City, L. I.

September 4th (about) 1-day meet for

Detroit Aerial Water Derby

Curtiss Marine Trophy
Class Race Prizes
Invitation Races
Speed Trophy

Place: Detroit River and Lake St. Clair.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

September 15th (about) 3-day meet

Pulitzer Trophy

Detroit Aerial Derby

for Aviation Country Club of Detroit Trophy and Liberty Engine Builders' Trophy and Class Race Prizes
Invitation Races

Detroit News Aerial Mail Trophy

for Multimotored Aeroplanes Speed Trials
Place: Mt. Clemons Field, Detroit, Mich.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

August 15th (about)

In Preparation by the Aero Club of America

American Elimination Trials, if Necessary for La Coupe Deutsch de la Meurthe (Race to be held in France about October 1st. Place: Mitchel Field, Mineola, L. I., N. Y.

September 30th

First Annual Interservice Championship Meet

Open to the personnel of
The U. S. Army, Navy and Marine Corps Air Service
Championships in Single Seater Fighting Bombing Reconnaissance Races Photography Races Formation Flying, Etc.
Location: Mitchel Field, L. I., N. Y.

August 1st (about)

Foreign Events

Coupe Jacques Schneider
Contest for Flying Boats and Seaplanes
Place: Italy (probably Venice).
Conducted by: Aero Club d'Itali, 24 Via Tor de'Specchi, Rome.
American entries received by the Aero Club of America.

October 1st (about)

Coupe Henry Deutsche De La Meurthe Race for Aeroplanes
Place: France.
Conducted by: Aero Club of France, 35 Rue François-1, Paris.
American entries received by the Aero Club of America.

The AIRCRAFT TRADE REVIEW

Additional A. C. C. Members

The following names have been added to the membership of the Aeronautical Chamber of Commerce:

Airship Manufacturing Co. of America, Hammondsport, N. Y.; Beckwith Havens, Airship Manufacturing Company of America, Hammondsport, N. Y.; C. C. Witmer, Airship Manufacturing Company of America, Hammondsport, N. Y.; C. M. Manly, New York City; B-G Corporation, New York City; American Hammered Piston Ring Co., Baltimore.

Aeroplane Exports

According to the Bureau of Foreign and Domestic Commerce, of the Department of Commerce, aeroplane parts to the total value of $19,173.00 were exported during the month of November 1921, going to England, Canada, Mexico, Japan and Australia.

Aluminum Men Fear German Competition

Washington.—Unless the aluminum industry gets high protection it will be destroyed by German competition, J. M. Ramsey of Cleveland declared Jan. 9th before the Senate Finance Committee. He asked for a general rate of 45 per cent ad valorem on American valuation.

Wright Engine Instruction Book

The Wright Aeronautical Corp. has just issued a useful instruction book dealing with Wright engines.

The volume is bound in oil and water proof imitation leather, and is divided into three sections. The first is devoted to a description of their engines; the next deals with installation and operation; and the third division takes up the question of overhauling and repairing. There are also chapters giving tabulated data on Wright engines, and a list of tools necessary for their handling and repair.

The book is profusely illustrated, nearly all of the drawings being as plain as paper and ink can make them, the idea being to make the entire volume clear to everyone who is to handle these engines, be he pilot or mechanic.

Prices for Wind Tunnel Tests at the Massachusetts Institute of Technology

All the prices appended include the plotting of the customary curves and the furnishing of 2 sets of blueprints and a brief report. The prices given relate to tests which take their place in the ordinary order of work. Rush tests can be put through by overtime work at an increase in cost of from 25 to 100 per cent. The usual time for the completion of a test on a single wing or model is 10 days from the receipt of the model to the despatch of the report, but this time can not be guaranteed.

All tests will be run at a wind speed of 40 M.P.H. unless otherwise requested. The highest speed possible is 65 M.P.H. Models should be approximately 18 inches in span and should not in any case exceed 24 inches. Fuselages and airship forms may be from four to six inches in diameter. No model should weigh over four pounds, and the lighter the better. In constructing models the methods outlined in Report No. 74 of the National Advisory Committee for Aeronautics (Construction of Models for Wind Tunnel Test) should be followed. Models can be constructed at the Massachusetts Institute of Technology if desired, the average cost being $22.00 for a rectangular wing model of constant section and from $40.00 to $100.00 for a tapered wing.

Type of Experiment	Price
Single rectangular wing of constant section, lift and drag....	$25.00
Do., with c. p. travel...........	30.00
Single wing of varying chord or section or with dihedral, lift and drag	30.00
Do., with c. p. travel..........	40.00
Complete model, lift and drag....	35.00
Do., with vector diagram or pitching moment curve, as desired	45.00
Extra charge for running any of the above at 2 speeds.........	12.00
Do., 3 speeds	20.00
Each additional moment curve plotted from the same test........	7.00
Each additional elevator or tail-plane setting on same model..	20.00
Biplane or triplane combination, lift and drag..................	35.00
Test of each wing of biplane combination in presence of another, lift and drag..................	60.00
Do., triplane combination.......	85.00
Fuselage or other simple parasite resistance test, one angle......	15.00
Do., several angles, with pitching or yawing moments...........	25.00
Test of stability in side-slip (yawing moment, rolling moment, and cross-wind force at angles of yaw)	100.00
Do., each additional setting of controls on same model........	40.00
Test for longitudinal damping coefficient	125.00
Do., each additional tail or other change in condition on same model	40.00
Test for downwash on tail-plane, including routine test for lift and drag	90.00

These prices are subject to change without notice and a new price list will be issued not later than June 1, 1922. Work not covered by the above specifications will be charged for in proportion to the amount of labor required and the time during which the tunnel is occupied.

Outspinning the Spider

Under the title "Outspinning the Spider," John Kimberly Mumford, who has written a number of books on industrial subjects, tells for the first time the history of wire-rope making in this country, from the beginning of the industry in 1840 by the John A. Roebling Sons Co.

"Outspinning the Spider" relates the romance of the Brooklyn Bridge; of the wire rope barrage laid down in the English Channel during the late war, and other interesting engineering achievements.

Copies of this interesting booklet can be secured from the Robert L. Stillson Co., 8th Ave. and 33rd St., New York City.

LOG OF CURTISS METROPOLITAN COMPANY'S "SEAGULL" NO. 1 FROM PORT WASHINGTON, N. Y., TO PALM BEACH, FLORIDA, DECEMBER, 1921

PILOT—CLIFFORD L. WEBSTER. MECHANIC—HORACE WILSON.

To	*Miles*	*Minutes*	*Average Alt.*	*Relative Wind*	*Date*	*Remarks*
Atantic City, N. J.......................	115	149	20 feet	Fresh head.	December 10	Rough air and water.
Churkategue, Va........................	120	144	10 feet	Fresh head.	December 10	Rough air and water.
Manteo, N. C........................	160	122	1500 feet	Moderate following.	December 11	Good air.
Beaufort, N. C........................	110	115	2500 feet	Strong side.	December 11	Good air, rough water.
Swansboro, N. C........................	25	30	10 feet	Light head.	December 11	Good air, rough water.
Southport, N. C........................	75	87	10 feet	Fresh head.	December 12	Rough air, rough sea.
Charleston, S. C........................	153	162	10 feet	Fresh head.	December 12	Rough air, rough sea.
Tybee Island, Ga........................	92	100	10 feet	Moderate head	December 12	Rough air, rough sea.
Fernandina, Fla........................	105	111	10 feet	Moderate side.	December 13	Rough air, smooth sea.
Titusville, Fla........................	160	156	300 feet	Moderate side	December 13	Moonlight, good air.
Palm Beach, Fla........................	142	116	1200 feet	Moderate following.	December 14	Good air, smooth sea.
	1257	1292				

Start: December 10, 1921, at 10:11 a.m. Finish: December 14, 1921, at 9:30 a.m. Elapsed Time: 3 days, 23 hours, 19 minutes. Flying Time: 21 hours 32 minutes. Gas Consumed: 265 gallons. Oil Consumed: 12 gallons. Average Motor Speed: 1550 R.P.M.

Notes: Excepting that obtained at Atlantic City, gasoline was the ordinary grade of Texaco and Standard Oil gas. Mobile Oil, B, was used when procurable; at other times Polarine and Texaco heavy oils were used. The motor ran perfectly. No attention was given it other than supplying gas, oil and water and draining gasoline strainer. This motor had over 550 hours flying before the start of the trip. The plane and hull required no repairs or adjustments. Over half a day was lost at Tybee Island, Georgia, waiting for a strong head wind to shift. Start was made at 3:30 p.m.

CLIFFORD L. WEBSTER (Pilot.)

AERO CLUB BANQUET INAUGURATES ERA OF AERONAUTIC CO-OPERATION AND CO-ORDINATION

THAT the 14th Annual Banquet of the Aero Club of America inaugurated a new era of co-operation and coordination in aeronautics was the consensus of opinion of everyone present. Congratulations are due the officers and governors of the Club on the success of their efforts.

The Hon. Benedict Crowell, president of the Aero Club of America, was the presiding officer, and he was accompanied on the platform by Charles F. Kittering, toastmaster, and the following honorary guests:

Rear Admiral W. F. Fullam, U. S. N.; Major General Mason M. Patrick, A. S., Chief of Air Service: Rear Admiral William A. Moffett, U. S. N.; Honorable Fred C. Hicks, Jr.; Captaine de Lavergne, French Air Attaché; Lieutenant Colonel A. Guidoni, Italian Air Attaché; Captain St. Clair Streett, A. S.; Captain George W. Hamilton, U S. M. C., and Captain Eddie Rickenbacker.

The Speeches

PRESIDENT CROWELL: Gentlemen, in behalf of the Aero Club of America I am pleased to welcome you, Guests and Members, to this, the Fourteenth Annual Banquet. During the last few years, especially since the last Banquet of this Club, the World has been changing very fast, and in nothing faster than in aeronautics.

It is necessary for this Club to keep pace with these changes, and we are about to be made into a National Association. The National Air Association and other organizations are about to join forces with us, and to work for a common end. In fact this day a Committee was appointed to work out the details of the National Association.

The main purposes of the Club are, briefly, these:

1. Recognize the broad national aspects of the Club's responsibilities and plan for an immediate attack of those problems which lie within the province of a civilian body devoted to the development of the aviation art.
2. Remove the headquarters of the Club to Washington and separate the activities from all social functions of a local or clubhouse nature.
3. Make the Aero Club of America a truly national business institution for the furtherance of American aviation in all its phases—a body representative of all proper aviation interests and of every section of our country.
4. Devote the influence and strength of the Club to the promotion of the national security and welfare through aviation development along the following general lines:
   (a) Securing the enactment of the basic legislation necessary to Federal Control of the Air.
   (b) The establishing of a governmental agency charged with responsibility for the Federal examination and license of pilots, and for the periodical inspection and safety of all aircraft and their equipment—to the end that flying may be made safe and the public welware properly guarded.
   (c) The adoption by the Government of a comprehensive and continuing national policy of aircraft development—including the mapping of air routes, the establishment of aerodromes, the maintenance of communicating and meteorological services, etc.
5. Effect the formulation of the rules and regulations for the Government of all kinds of aeronautical trials for contests and the promulgation and proper administration of these rules.
6. Accept the responsibility for the verification and certification of the results of all trials and contests and of all records arising therefrom.
7. Collect and disseminate to Club Members aeronautical information of all kinds.
8. Serve as the American representative of the F. A. I. and actively participate in all international aviation projects.
9. Bring about an affiliation with the activities of the Aero Club of America of all responsible bodies whose energies are directed to the development of any phase of our national air development.

It is even possible that a slight change in the name of the Club will be made. Among the immediate interests is our helping forward the Wadsworth-Hicks bill now before Congress, and to that end I am going to ask for the adoption of this resolution:

Resolution

Whereas, the Aero Club of America is a national organization, including in its membership the principal and various elements actively concerned with developing the art and science of flight most advantageously for the Government and for the nation at large; and

Whereas, it is now apparent that the National Government should provide for Federal supervision and regulation of aircraft and aerial activities among civilians, and that the chief executive and administrative heads, chiefs of bureaus and others dealing with aviation are unanimous in their support of the bill recently introduced in the Senate and in the House, i.e., Senate Bill No. 2815 (The Wadsworth Bill) creating a Bureau of Civil Aviation in the Department of Commerce "to encourage and regulate the operation of civil aircraft in Interstate and foreign commerce; and for other purposes,"—

Therefore, Be It Resolved, That the Aero Club of America, at its Fourteenth Annual Dinner, in the City of New York, recommends immediate and decisive consideration of the abovementioned bill; and

Be It Further Resolved, That the Secretary of the Aero Club of America be instructed to mail copies of this Resolution to the President and the members of the Senate, and the House, representatives of the Congress of the United States, to the Clerks of both houses and to the Secretary of Commerce.

I am going to ask for the endorsement of that Resolution. (Motion for the adoption of the Resolution was seconded and carried unanimously.)

I shall now ask Mr. Edwards to conduct the program for the next few minutes.

MR. CHARLES JEROME EDWARDS: Gentlemen, this is a very great privilege which I am now to enjoy.

You men of the Aero Club of America and friends of aviation are here to-night to take part in the presentation of these trophies and certain other medals of award.

Trophy and Other Awards

The first Trophy, and it is one that has taken place—large place—in the annals of Aviation, is the Pulitzer Trophy, won this year by Bert Acosta. You will all understand and sympathize with him when I tell you his absence from this meeting to-night and the opportunity for us to pin this Medal on him, is occasioned by a most sad occurence in the most intimate relations of his family life.

He won this Trophy in a Curtiss Navy Racing Plane, equipped with a 12-cylinder, direct drive Curtiss motor. Mr. Acosta established a world's record of 176 miles per hour for competition over a closed circuit; the previous record of 173 miles per hour having been made in October in the Race for Coupe Deutsche de la Merthe, and won by Sadi Lecointe.

The Medal of Merit of the Aero Club of America has been awarded by the Board of Governors of the Club to Mr. Acosta for this record.

I will ask Mr. Post, if he is here, or some representative of the Aero Club, to take charge of this Medal for the World's Cross-Country Speed Record of 176.7 miles per hour, made in November, 1921, to see that it reaches Mr. Acosta.

The next is the Mackay Army Trophy, competed for annually by army officers in the Air Service. It has been awarded by General Patrick to Lieutenant Macready, for establishing a new world's altitude record of 37,800 feet in a LePere aeroplane, with a 12-cylinder Liberty motor, equipped with a Morse supercharger.

The Medal of Merit of the Aero Club of America has been awarded by the Board of Governors of the Club to Lieutenant Macready for this record.

Now, we have here the Medal of Merit of the Aero Club of America which has been awarded by the Board of Governors of the Club to Messrs. Stinson and Berthaud for establishing a world record of endurance by remaining in the air 26 hours, 19 minutes and 35 seconds. This feat was accomplished with a Larsen all-metal monoplane. They got their pictures in the papers and in the movies; and we are darn proud of them as they did a big thing for America and for the Aero Club and for an American manufacturer. And the strange thing is, they remained in the air for these 26 hours and 19 minutes using coffee only. That is what they said, anyway—and it was on the 29th and 30th of December, which beat the former record made in France.

On behalf of the Aero Club's Governors we bid these gentlemen step forward and let us place these medals in their possession.

Now, we have the Collier Trophy, presented by Robert J. Collier, to be awarded annually for the greatest achievement in

Aviation, the value of which has been thoroughly demonstrated by use during the preceding year. It has been awarded for 1921 to *Mr. Grover Cleveland Loening for his development of the Loening Flying Yacht,* which attains a speed of 135 miles per hour, reached an altitude of 17,500 feet with four passengers, and has thoroughly demonstrated its air worthiness and its sea worthiness by constant use over a period of three months.

We will undertake to see that the custody of the Collier Trophy is placed with Mr. Loening.

The next is the *Wright Trophy,* donated for the best completed aerial demonstration to or from New York City within eight hours, judged entirely in a non-technical way, and from a prospective buyer's standpoint; it also has been awarded to *Mr. Grover C. Loening* for the six flights made in his flying yacht between Port Washington and New London, based upon 100 percent performance, 100 percent safety. The flight being made in a water-machine over an all-water route, in 33 percent of railroad time, and with a variation of only two minutes in trips in the same direction and of only sixteen minutes greatest variation between any two trips.

We regret that the Trophy has not at this time been completed, and so cannot be delivered at this time.

The next is the *Larsen Efficiency Trophy.* The Aero Club of America cannot announce the winner of this contest at the present time, owing to an appeal having being made to the Aero Club of America against the decision of the Aero Club of Omaha. This appeal has been under consideration, and is now under consideration by a Special Committee appointed by the Board of Governors of the Club; but due to the nature of the evidence the Committee has had to take more time than would ordinarily be required in deciding a sporting event. This takes me back to the year 1910, when Grahame-Wihte worried us, and then charged us six percent interest for the money we held in trust.

Now, we have presented these trophies obtained for success by our pilots in 1921. What about 1922? The more important trophies exhibited will be competed for as follows:

The Curtiss Marine Trophy at Detroit, Michigan, above the Detroit River and Lake St. Clair, on Labor Day, September 4th, preceding the Gold Cup or International Hammondsworth Trophy Motor-Boat Races. Detroit, the fourth largest City in the United States and the center of the Great Lakes population last year, had 400,000 people on the shores of the City and Belle Isle to witness the Motor-Boat Races.

The Aero Club of America knows of no better place, geographically than Detroit, to introduce seaplane and flying-boat contests, nor of any location that has the enthusiasm over water sports.

The Pulitzer Trophy Contest will be held in Detroit, starting and finshing at Selfridge Field at Mt. Clemens. This field has every facility and the proposed course offers ample landing fields in case of mechanical failure.

The Detroit Aviation Society assures the contestants of efficient management.

In addition to the Pulitzer Trophy there will be contests for the Detroit Aviation Country Club Trophy, Liberty Engine Builders Trophy and Detroit News Aerial Mail Trophy. These will embody contests for single and multi-motored commercial planes.

The Aero Club has in preparation an Inter-Service Championship Meet similar to the championship tournament of any sport, in which the representatives of the Army, Navy and Marine Corps Air Services, previously selected by elimination trials, or other rating, meet to decide the individual and interservice championship for the year.

The Aero Club hopes that America will be represented in 1922, both in the Coupe Henry Deutsche de la Merthe, and the Coupe Jacques Schneider, for seaplanes and flying boats, which are the important foreign races; and we should not neglect the opportunity offered us to compare our development with theirs.

I now come to the Petition—and I am compelled to say that *Caleb Bragg* is the most efficient, most untiring and most unselfish Chairman we have ever had on the Contest Committee; and his fidelity to the job has been as great if not greater than any man I have known in like relationship in my long and happy connection with Aviation. Mr. Bragg got this up.

Due to the great number of requests to send Government aeroplanes to all parts of the country to participate in patriotic celebrations, municipal and State functions, conventions, airmeets, etc., received by the Air Services, these Departments were compelled to bring the matter to the attention of the Secretary of War, who issued an order that no Government aeroplane should participate in any of the above events. Unfortunately no provision was made which permitted the Air Service to participate in the events organized, with their approval and under their direction, by the Aero Club of America.

Therefore, a petition to the President of the United States has been drawn up and adopted by the Board of Governors of the Aero Club of America, which I shall read, and—with the approval of General Patrick and Admiral Moffett will submit to you gentlemen for your adoption.

The petition was then read.

Mr. Edwards: I will ask now if you will hear General Patrick second this Resolution or Petition.

General Mason M. Patrick: Yes, Mr. Edwards, I second it most heartily.

Mr. Edwards: I will suggest another seconder; and I name Admiral Moffett.

Admiral Moffett: Speaking for the Navy I heartily second that; and as far as I am concerned the Navy will go into each and every one of these races.

Mr. Edwards: The Chairman has asked me to put the question as to this petition which has been so heartily seconded by both the Army and the Navy. Are you ready for the question? (Shouts of *Yes*). All in favor say Aye. That is fine. There can be no Noes there. It is adopted unanimously. (Petition handed to President Crowell.)

President Crowell: It is now my great pleasure to introduce to you as your Toastmaster one who needs no introduction, I am sure,—*Mr. Charles F. Kettering.*

Toastmaster Charles F. Kettering: Mr. Chairman and Gentlemen, you know I could not help as I sat here but contrast this Dinner with some we have had previous to this, "in the good old days" before the Country went dry, when the speakers as well as the guests had something to drink. Not having it makes the problem up here a little more difficult.

You know while Mr. Edwards told all about the 400,000 people who collected on the shores of Lake St. Clair to view the motor boat races, he did not say on which side of the river they were. Detroit, let me assure you, has other attractions than merely being fourth city in population.

Now, we have a long program tonight, and I regret it as I have to cut my own stuff short.

First we have a lot of letters and telegrams which I shall read:

Greatly regret my inability to accept your invitation and be with the Aero Club at its Banquet tonight. I shall hope that the occasion may bring further encouragement to American interest and effort in the growing field of aeronautics.

(Signed) President Harding.

I have your letter of December 29th inviting me to be the guest of the Aero Club of America at the Fourteenth Annual Banquet to be held at the Commodore Hotel, New York, on Monday evening, January 9th, 1922, and regret that an engagement in Washington for that day will prevent my accepting your cordial invitation.

(Signed) John M. Weeks, *Secretary of War.*

Impossible for me to leave Washington today much as I would like to be on hand tonight to help in the good work that is being done by the Aero Club. Best wishes to all for the New Year.

(Signed) E. H. Shaughnessy.

Greetings for the New Year. Development of Aeronautics both Commercial and Military is taking precedence over any other transportation or national defense agency in Europe. Keep up the good work of developing our aeronautics.

(Signed) Mitchell.

Sorry I am unable to be present tonight. Please extend my greetings to the members and guests of the club. The past year has been one of unusual progress in aeronautics toward which progress the Aero Club has contributed its full share. Wishing you a most successful meeting, sincerely yours,

(Signed) Orville Wright.

I regret most sincerely my inability to be present at 14th Annual Banquet and offer best wishes for its success and the success of aviation and the aeronautical industry of America in general and in particular.

(Signed) Air Commodore Charlton.

I have just wired you as follows: "Regret impossible to accept invitation to attend banquet of Aero Club January ninth, Most appreciative of invitation."

I very much regret it isn't possible for me to accept the invitation. I have been away for three weeks getting a short rest, the first I have had since 1914, and must stick to the job here now for the next few weeks. I am very sorry I can't come. Nothing would give me more pleasure than to be with you, as you know I am very much interested in aviation.

(Signed) Will H. Hays.

Your letter of December 29th, 1921, inviting me to be the guest of honor at the Fourteenth Annual Banquet of the Aero

Club of America, to be held at the Commodore Hotel, New York City, on Monday evening, January 9th, is brought to my attention on my return after a short absence from the city. I regret very much that I cannot be with you. I am to be in New York on January 10th, but press of official duties here will not permit me to extend my absence from Washington for a single day. I appreciate your courtesy, however, and wish it were possible for me to accept.

Will you be good enough to convey to the members of the Aero Club and their guests my best wishes for a pleasant and profitable evening.

(Signed) EDWIN DENBY.

Rear Admiral W. F. Fullam's Speech

Mr. Toastmaster and gentlemen of the Aero Club of America:

I cannot feel that I deserve the compliment of addressing you tonight. The world is facing a new era, an era which will bring aeronautics to the front and give it a proper place in peace and war.

The Conference in Washington has decreed the scrapping of 66 battleships and a holiday of ten years in battleship building. This momentous decision stops a mad race in enormously expensive ships that are doomed by modern weapons. It saves hundreds of millions, reduces taxation the world over and lessens the danger of war in the near future.

For these reasons alone every man, woman and child in the world should pray for the ratification of the decrees of this Conference, by all civilized nations. To defeat or reject the righteous measures agreed upon by the delegations to this Conference would be a crime far more reprehensible than that of the German Kaiser in 1914. There would be a less excuse for such action today than there was for the militaristic spirit that precipitated the World War. The picking of petty flaws, and the carping criticisms of the Conference with a view to wrecking a wonderful accomplishment, will not be tolerated by the people of this country.

Wars Will Not Cease

But it must not be assumed that wars will cease forever. Pacifists must not beguile us into a state of effeminate unpreparedness. In discouraging wars, in condemning aggression, in abolishing inhuman methods, in protecting neutrals, non-combatants and innocent commerce and in reducing expenditures for out-of-date weapons we must not throw all reason overboard. We must recognize that human nature has not changed. Jealousy, envy and greed still exist among the nations of the earth. We see proof of this in the proceedings of the conference that has done so many splendid things in the past two months! We can only postpone war. We can only reduce the number of wars by removing causes that are plainly inviting immediate hostilities.

The Conference Modernizes Naval Thought

One of the most importane results of this Conference is to modernize naval thought, and set naval and military minds free from the thralldom of conservatism. Our naval policy was virtually based upon one lone idea—the battleship. The naval brain, during the past eight years has harbored but one thought—battleships. It saw nothing but battleships and battle cruisers, it dreamed only of them. It was tortured with the superstition, with the nightmare of the battleship!

This statement will be considered an exaggeration by certain conservative naval officers. They will claim that our policy included the building of other types of ships, and the encouragement of other weapons like submarines and air forces. But in truth, these weapons were advocated in whispers, while the need of battleships was sounded by a megaphone. Money was poured out for capital ships, but it was vouchsafed in miserly pittances for the new weapons that are essential in modern war. I know this from personal experience. A statement to the Senate advocating a fleet of 21 dreadnoughts and the suspension of the 1916 program beyond that, in order to provide money for submarines, aeroplane carriers and aeroplanes, was received with impatience and hostile action!

"Battleshipitis"

The feeble statement by Congressmen and others that the principle of a three-plane-navy was recognized by the advocates of the 1916 program resulted in no action to support this intelligent declaration. There were hundreds of millions for capital ships and comparatively nothing for the forces in the upper and lower planes—for air forces and submarines.

But the Conference has provided a tonic that may cure this awful disease of "battleship*itis*." If we are to build no more of them for ten years, naval officers may turn their minds to the development of something else. The one idea which completely filled their brains may now to be permitted to hybernate so that two or three other ideas may find birth and nourishment. There is hope.

Mackay Army Trophy
Presented by Clarence H. Mackay.
Won by Lieut. Macready for establishing a world's altitude record in a Liberty motored Le Pere

And it must be recognized that this naval malady, "Battleshipitis," was not restricted to the United States. This naval plague was found everywhere. It raged in England and Japan, and other nations were saved from it only because they could not raise the billions necessary to create battleship fleets. It threated to bankrupt the world.

Conservatism in the Navy

The craze for battleships in 1922 was born of conservatism. In a recent lecture at the Naval War College, Admiral Sims demonstrated that conservatism has always kept military minds in a rut from the days of Noah. Let me briefly review our own Naval history. In 1862 the Monitor and the Merrimac proved that wooden ships were useless against armored ships in war. Had the Merrimac beaten the Monitor she would have raised the blockade and won the war for the South. Farragut, with his wooden ships, triumphed simply because the South had no navy.

Following the Civil War, we profited little by its naval lessons. We had virtually developed the all-big-gun ship, the Dreadnought of today. The Monitor contained all the germs. The double-turretted Monitors Miantonomah, Monadnock, Puritan and Terror were low-freeboard Dreadnoughts. The Monadnock rounded Cape Horn, the Montonomah cruised to Europe. This proved that the Monitor was a sea-going fighter. It was the most powerful ship afloat.

Foreign Nations Outshipped U. S.

But we stopped, while other nations progressed. We returned to antique wooden ships, while European nations built iron and steel ships and developed the modern battleship. I cruised in the Mediterranean from 1877 to 1879 in wooden ships, the Marion and Trenton. It was humiliating. In every port we found armored ships of Italy, Austria, France and England. Italy had the Dondolo and Duilio with their hundred-ton guns. The Stars and Stripes were carried by wooden arks with 9-inch smooth bores or converted rifles! The Trenton, the pride of the navy, was a wooden cruiser with a ram bow. Sticking out 100 feet ahead of the ram was a bowsprit, a jib-boom, and a flying jib-boom! Towering spars, and yards on three masts, were loaded with the rigging and sails of a full powered sailing ship! And it may be said that this top-hamper sent the Trenton to her doom in the Harbor of Apia a few years later. She could not steam against a hurricane, and force her way to safety in the open sea, following the British cruiser Calliope —a modern ship!

Clinging to Sails

And strange to say, we still clung to sails for fighting ships. In 1887 to 1889 I cruised in the Boston and Chicago of the

The Collier Trophy awarded to Grover C. Loening for his development of the Loening Flying Yacht

"White Squadron." They were loaded with masts, spars, topsails and top gallant sails! We could not give up this ancient impediment in a modern naval age!

And so it happened that until we built the grand old Oregon, the Massachusetts, and the Indiana—more than 30 years after the Monitor and the Merrimac—we were sleeping in the arms of Conservatism, building wooden ships and sailing vessels, while foreign nations were designing fleets of modern battleships, any one of which could have sunk our entire Navy!

The Conference Sets Us Free

Now, gentlemen, is it not plain that the same conservatism that stifled progress in our Navy for thirty years following the Monitor and the Merrimac might have continued to hold naval officers and Naval Committees in double irons had not this Conference stopped the mad battleship mania and struck the shackles from enslaved naval minds! How long would we have waited for a recognition of modern weapons with naval brains so hidden behind the armor of our Dreadnoughts that the light of a new era could not penetrate? But the Conference has decreed a scrapping carnival, and a ten-year battleship holiday. Naval intelligence may now come from behind armor and assert itself. It may get on the road to progress and provide us with a modern navy—a three-plane-navy. It may distribute the appropriations wisely on the three planes, and it may develop a type of surface vessel which will be less expensive, less vulnerable, and more useful then the $45,000,000 Dreadnought of today. We *must* have a surface Navy. There can be no Navy without ships. There will always be fighting ships upon the sea. It is a question of types—that is all.

Gentlemen, in condemning conservatism, we must admit that it has some virtues. We must be fair. In the indictment of a one-idea navy we must not convict ourselves of being the slaves of one idea—the victims of *some other* than the battleship mania! In avoiding Scilla we must not fall upon Chribdis!

Conservatism Has Virtues

Conservatism at the Navy Department has often served a good purpose. There is reason in all things. If the Navy Department had accepted every innovation, every invention, and had changed its building policy to accord with the views of every invention, and every theory advanced and urged during the past fifty years there would have been no money left in the United States. There would have been a scrap-heap of useless contraptions higher than Mt. Everest, and the Navy would have been successfully controlled by crazy, half-baked theories which would have brought us to zero in Naval efficiency.

Avoiding Extremes

And so, we must always be conservative within limits. We must distinguish between things that have been proved and things that are un-proved. We must never claim too much for a new invention or a new weapon. In doing so, in overstating our case, we weaken our position and reflect upon the soundness of our judgment. In promoting Aviation in the Navy, for instance, we must not claim that all surface ships and all Dreadnoughts must be immediately scrapped. We must keep what we have until we get something better. We can not jump overboard off our battle fleet and swim around in the Atlantic and Pacilc Ocean with nothing to land upon!

The Conference at Washington has intelligently recognized this fact. We are still to have 18 battleships, and hundreds of destroyers, cruisers, submarines and plane carriers. We are still to have the strongest surface Navy in our history. But it is wisely decreed that we will build no more battleships for ten years. During that interval we can develop new types. We can give to other weapons their proper place and their relative value in a Three-Plane-Navy. This is the gist of the whole subject. This is not a *one*-idea Navy. This is a *three*-idea Navy. This is not a weak Navy; it is a strong Navy. It is a modern Navy, the kind of a Navy that every loyal American citizen should support.

The Future

So much for the past. Now for the future. We know Naval history up to date. We must now anticipate the conditions of the years to come. Aviation is no longer a theory—it is a living condition. The aeroplane is no longer an untried, untrustworthy, unsafe, unproved flying machine! It is a tried, trustworthy, safe, and invaluable means of travel. It is now a commercial necessity. It will become more necessary and more valuable every day from this time on.

But it is not my place to speak of the commercial value of aviation. It is, however, the duty of every naval officer to study and develop the usefulness of the aeroplane as a weapon. In this we must lead the world, we must not follow.

We must be in front; not behind. Our Navy must be up-to-date, not archaic.

The Bombing Tests

Recent tests have proved, beyond question, that *the aeroplane will be the dominating factor in future wars on land and sea.* Aeroplanes discovered the Iowa within a sea area of 20,000 square miles in less than three hours. As a scout, the aeroplane is supreme. Aeroplanes sank the German ships—a battleship, a cruiser, a destroyer and a submarine with ease. The Joint Board reported that bombs alone could sink any ship that can be designed. The percentage of hits in all these tests was high, remarkably high, when we consider the crude sights and the limited experience in bombing.

Conservatism now seeks to underestimate and belittle these tests. This attitude is as unfortunate and unwise as it is futile. It is claimed that the planes had an advantage in the attack because the targets were anchored and could not fight back. On the contrary, it may be claimed that they would have been sunk or disabled much sooner had the ships been under way with engines and boilers in operation, magazines filled, ammunition, torpedoes, and depth charges around the decks and steering gear vulnerable to attack. General Mitchell's claim that under such circumstances, and with freedom to attack in force and with weapons of his choice he could have sunk or disabled the whole squadron in fifteen minutes is perfectly reasonable. *I witnessed these tests and I believe Mitchell's claim is justifiable.* Moreover, I believe that a foreign fleet that does not command the air above itself constantly night and day *will be destroyed, disabled or driven off, if it comes within one hundred miles of our coast, provided the United States supplies itself with a strong air force.*

Anti-Aircraft Guns

The defense of a fleet by anti-aircraft guns is not possible. The masts, smoke pipes, bridges, radio and other obstructions so interfere with these guns that their field of fire is very small. Moreover they are inaccurate at best. This is especially the case with small ships, rolling and pitching at sea. I am reminded of a story told by Admiral Sims. Two men were out shooting. One of them *stuttered* and the other had *Saint Vitus' dance.* One could talk with difficulty, but his nerves were steady. The other could talk perfectly, but every muscle in his anatomy twitched constantly. The man who stuttered saw a bird, took deliberate and deadly aim, fired, and *missed.* The man with Saint Vitus' dance quickly threw up his gun, the *muzzle wabbling all around in circles,* fired and brought down the bird. His friend exclaimed: W-well; n-no wonder you h-hit him! You a-aimed *EVERYWHERE!* Here we find the only hope of the anti-aircraft guns. If they are manned by sailors with Saint Vitus' dance, heaven help the airman!

The Night Attack

Now, consider a *night attack on a fleet, or ship,* by aeroplanes. The experiment with the Alabama was illuminating. The attacking planes flew 50 miles, located the Alabama among many ships and bombed her successfully. They were virtually invisible. With their exhaust pipes muffled, we did not hear them. They could have attacked at a very low altitude—near the tops of the masts—if necessary. Against such an attack, a ship is powerless. What could a fleet do if at anchor, or under way, to protect itself from a determined attack by air forces at night? Will somebody answer this question? And suppose the planes use mines and torpedoes besides bombs? In truth, it is appalling to stop and calmly consider the danger to which a fleet at anchor or under way may be subjected by the attack of a well organized, well armed, and well drilled air force, especially at night. Personally, I do not believe that any fleet can successfully operate against such forces, or can survive such attacks. After an experience of more than forty years in training the officers, midshipmen and the enlisted men of the Navy, noting their intelligence, their fearlessness, their devotion to the traditions of the Navy and their loyalty to country, and after viewing the dauntless spirit and skill of Gen. Mitchell and the First Provisional Air Brigade at Langley Field, I am convinced that *no foreign fleet will dare to come within two hundred miles of our shores, if we give these lads the proper weapons and the opportunity to use them. Air forces alone can protect a coast against hostile attack from overseas.*

Armies Cannot Cross the Sea

It is amazing that writers, and so-called experts—even Army and Naval officers—continue to talk about sending armies and fleets to invade or to attack a naval power across the oceans! Can it be done, if that enemy, on the defensive, commands the air? Is such a thing possible? It would appear to be an insane proposition. I wish every man here tonight would read an article by Vice-Admiral Mark Kerr of the British Navy in the Nineteenth Century Magazine for last September. There are American Admirals who fully agree with Admiral Kerr. But they have not felt at liberty to publicly express their opinions on this subject. I believe, however, that they may be encouraged and permitted to do so if the proceedings of the Washington Conference are ratified by the Senate and the people of the United States. Aviation will soon have an inning.

Gentlemen, air forces will discourage or prevent war overseas. The aeroplane is a God-send! It will localize war. It will limit wars to the continents. Intercontinental wars will be impossible, or very infrequent hereafter. Armies cannot again cross the oceans in the face of submarines and air forces. There will be naval wars, but they will be limited. Fleets cannot attack a coast in the future. Air forces will promote the freedom of the sea and protect weak nations.

Bad Weather

Conservatism claims that the aeroplane, the aeroplane carrier, and air forces generally will be rendered ineffective by bad weather, fogs, gales, etc. But all naval operations are similarly affected. Aeroplanes have flown from London to Australia, from New York to Alaska, from San Diego to Panama, across the Atlantic and only the other day Stinson and Bertaud *remained 27 hours in the air in mid-winter during snow storms, and in a gale of wind.* Can a hostile fleet safely approach our shores defying men who do such things in the air? And we must remember that the weather is not always bad. Even admitting that an air force could not always attack in bad weather, would a fleet cross the ocean to attack us, or would we send a fleet to attack overseas with bad weather as our only hope?

Perhaps Army and Naval officers would be less prejudiced against the aeroplane if they could be induced to regard it as a gun and not as a flying machine. *And in truth, it is a gun—the most powerful and effective gun, with the greatest range, the heaviest projectiles, the greatest variety of offensive and explosive agents known in history.* It can carry 4,000 pounds of bombs, large or small, torpedoes, and mines and attack an enemy hundreds of miles distant. Other guns are tied to the beach or to the ship. The aeroplane gun can move to a base anywhere along the coast. *All the planes in the United States can be mobilized against an enemy in a few hours.*

Forts Vs. Aeroplanes

We have considered the helplessness of ships against air attack. How about Forts? Can the forts on our coast, with their 16-inch guns, successfully resist the attack of the 2,000-pound or 4,000-pound bombs? Are they safe at night? Picture such an attack! And compare the usefulness of the guns of a fort with the aeroplane against a hostile fleet, especially at night! The guns of forts and ships are comparatively useless at night. *But it is at night that the air force will get in its deadly work—in comparative safety. It would appear that air forces will be trained and will be used principally to attack at night. If so, it is difficult to see how they can be repelled.*

The Aviation Medal of Merit of the Aero Club of America, presented to Bert Acosta, for establishing the world's speed record; Lieut. Macready for the world's altitude record, and Eddie Stinson and Lloyd Bertaud for the world's endurance record

Limitations of Aeroplanes

It would be unfair not to note certain limitations of the aeroplane as a weapon. Although it carries the heaviest projectiles and the greatest variety of projectiles, it must return to base or to the carrier after it fires its supply of shells, torpedoes or mines—be it one or more. It must have landing fields and bases on shore and it must land on the carrier or in the water alongside and be hoisted on board before it can renew the attack. The problem of air forces operating from the shore is simpler than in operating from the ship. It is for this reason that navies and battleships cannot be scrapped. *The aeroplane carrier bids fair to become the capital ship of the future, but it is not yet fully developed.* We can safely predict, however, that an all-metal plane will be developed that can be handled and hoisted at sea as safely as a life-boat. A navy sea plane was navigated 250 miles in a gale by Comm. Towers and reached the Azores in safety.

The Aeroplane Defends Commerce

Viewing the aeroplane as a gun, it can be used by merchant steamers to protect themselves from attack at sea, provided the arming of merchant ships is not to be forbidden by international agreement. The Navy has developed a catapult which projects the aeroplane from a ship's deck and starts it in its flight. With this device all ships in the Navy and all merchant ships in time of war could be equipped to fight their own battles and protect themselves from enemy cruisers.

Air Power Will Dominate

The more we study this subject the more clearly we see that the Army and Navy must wake up and adjust their ideas to the inevitable. The money available for the military and the naval services must be expended on modern lines to give the best results in offensive and defensive warfare. Forts and battleships must not demand the lion's share. The weapons that can destroy and sink them must take precedence. The victor, not the vanquished, must be rewarded.

A review of this subject justifies the following conclusions:

1. Fleets and forts cannot resist air forces.
2. Armies cannot be sent overseas.
3. A fleet that does not command the air above itself cannot leave the home coast.

4. Aggressive war overseas will be difficult if not impossible.
5. Aeroplanes can attack ships with bombs and torpedoes, and can fence a fleet in with a barrage of mines.
6. A fleet may be completely at the mercy of an air-force attacking at night.
7. The aeroplane is a flying gun of great offensive power—greater than any other gun.
8. Inasmuch as aeroplanes can sink submarines and surface ships, or threaten them with a variety of weapons by day and by night, with as little danger from anti-aircraft guns, it would appear inevitable that sea-power will hereafter be dominated by, or be dependent upon air-power.
9. The next war, on land or on sea, will be won by the nation that commands the air.

General Patrick's Speech

Gen. Mason M. Patrick (U. S. A.): Mr. Toastmaster, and gentlemen: It is a great pleasure to be one of the representatives of the military air service here tonight to meet with the members of the Aero Club and their guests, and to feel that we are working to a common end, and that the great influence of this great body, individually and collectively, is exerted in behalf of the development of aviation. I suppose there are no people the whole country over who know how far we have fallen behind in this race in the air. And this in spite of the fact that speed is the central characteristic that makes transport by air most desirable, and one that should appeal very much to our people. In spite of the fact that this great country of ours, with its vast distances, lends itself to the development and the use of this method.

Now, there are two reasons for that, why the military air services are insistent that civil aviation shall be developed. First, our pride as Americans is galled when we find ourselves lagging behind. Second, we are concerned that we should have at our disposal in case we are ever again called on to defend ourselves, ever called on to take up arms, we will be in position to give a good account of ourselves. There must be a reserve air force on which the regular service can draw, trained aviators and manufacturers of aeroplanes which with slight changes can be made to serve the purposes of the military service. Unless we can de something to advance this air service, it may be disastrous to our country.

There are three essentials: first, legislation; legislation that will warrant the reliability of the man who flies, and the machine which he conducts. Second, a proper system of airways the country over, with facilities for repair and maintenance. Third, meteorological data, adequate and properly disseminated.

I think we will have these three essentials before long. I look forward to the day, and that soon, when we shall have aeroplanes with constant temperature cabins in which passengers can sit in comfort and fly at great speed. This means great breadth of view on the part of those who undertake it, and it cannot be brought about unless there is a unity of purpose and a national organization that will back it up and see that the United States gets what we ask for.

The air service has to train the little regular service, and the National Guard and the Army's reserves. We have just had a decision which makes it possible for us to take on military aerodromes and civil aircraft, and we will be able to provide facilities for their refitting and their repairs so they may proceed on their journey.

That is one step.

I go as far as the Secretary of War when he says that something must be done to encourage aviation. This can be by indirect aid, and if that does not produce the direct results, then we must go after it in another way. I speak for the Army air service. It has done considerable work since your last annual dinner. It is scarcely necessary for me to call your attention to the results of the bombing tests carried out in 1921 off the Virginia Capes, for they have given more thought to military men—and I include naval men under that designation—than anything else since gun powder was introduced. For the success of this I give all credit to Gen. Mitchell, for with his enthusiasm and energy and knowledge he was able to bring these results about which have startled the world.

There was gathered at Langley Field a group of men, and when the time came they did not fail to realize the effect it had on naval thought, and it has been expressed already much better than I could possibly express it by Admiral Fullam.

We feel as he does, that the air force can make us safe from aggression, no matter where it comes from; and that no fleet, no matter what its size, can imperil our shores; and it is impossible for any enemy fleet to bring with it an air force to enable it to work destruction in our land.

The Army has sent a bi-motor plane higher than ever before. This enabled Shroeder and Macready to rise to heights beyond any which living man had heretofore penetrated. In addition, I am told we have eliminated the caterpillar and the bollweevil, and I suspect that in the course of time in future wars you will find that with aeroplanes we are keeping the cooties off the boys. By distributing the reserves of the country and bringing the people closer together, the air craft are a means for preserving peace just as if aggression should come, they are means for resisting the aggression. I look into the future and see in the air service of this country new fields in which it can perform. I see our borders, north, south, east and west, linked by air-ways properly marked and lighted so that it will never be out of sight of means to identify where it is when it is in the air. This means safety; this means greater prosperity, and it means a greater United States.

Capt. Rickenbacker's Speech

Capt. Rickenbacker: Interest in civilian aviation is increasing rapidly among automotive and transportation engineers.

The various branches of the Government are taking it up in a serious way.

The presence here tonight of the Chiefs of the Army, Navy and Marine Corps flying services, and of leading engineers and executives in the automotive world is highly significant of the recognition being accorded the science of aeronautics.

For since the war, surmounting many of the obstacles which followed in the wake of the conflict such as hard times, business depression and general lack of confidence, or perhaps it would be better to say industrial unrest, aviation has managed to hold its own with other means of transport; in fact, it has done better than that, for isn't it conceded that we are farther along in aerial transport today than we were when the last annual dinner of the Aero Club of America was held in 1919—that year of social, industrial and economic problems in which there was no concrete promise for the sciences, other than a promise of hard times and bitter uphill struggle ahead.

We *have* progressed in aeronautics.

We, all of us, now understand the importance of the flying machine as a means of national defense. It is recognized as our third arm, and many of us believe that it is our most important arm—one which will increase rapidly in relative importance.

Civilian Flying Increased 20 Percent in 1921

As for civilian flying. It increased 20 percent in 1921 over the preceding year, according to statistics compiled by the Aeronautical Chamber of Commerce, which made a survey of the progress of flying among civilians in this country.

We have no official Government machinery for checking up on civilian flying by the Aeronautical Chamber of Commerce estimates that in 1921 approximately 1200 aeroplanes were operated by civilians in the United States.

These estimates place the total flying at 6,500,000 miles and the aggregate number of passengers carried during the year, 275,000.

The history of the development of transportation facilities presents a progressive improvement in type. The latest type to reach a high state of development is the automobile. This development has been reached in twenty years of the most intensive activity on the part of the best engineers and executives in this and other countries of the world. The legitimate successor, or the heir apparent to this rich heritage in the automotive field is the aircraft industry. Just as the automobile people twenty years ago commandeered the experience of the coach and locomotive builders and everything that had gone before, so the aeroplane engineers in their turn, with a full sense of appreciation and gratitude, commandeered all of the accumulated experience of the automotive world. Now that aeroplane design has passed beyond the stress of the war period and aeronautical engineers can further appreciate and differentiate this knowledge with a clearer perception of the difference between traction and flight, and with the greater breadth of vision that has come with the continued studies of the problem, all the automotive and aeronautical world will be drawn into a closer fraternity of parallel interst and mutual help. There is much that the automobile industry can and should profit from the special work of the aeronautical engineer by lightening the superstructure of motor cars.

Aviation Is Now a Practical Art

Bearing this in mind, we must consider aviation as a practical art.

Our Air Mail Service, three and a half years old, is one of the best examples of efficiency in the air. I am informed that it has a record of 89 percent efficiency since its organization in

May, 1918. It started out with a few army training machines carrying two or three bags of mail between New York and Washington. Today it carries the mail on regular schedule daily, and supplements train service all the way from New York to San Francisco. At 14 of the principal stations wireless equipment has been installed and is now operating, serving to perfect the communication system which all pilots need to insure successful flying cross-country. Provided with advance information concerning the weather, ceiling and condition of emergency fields along his line of flight, the air mail pilot has found it possible to bring the mails from the Pacific to the Atlantic within 48 hours elapsed time.

During the last year, private individuals and companies have literally flown all over the country. Every river, lake and coastline has been traversed by commercial flying boats. Our overland machines have hopped off in all kinds of weather, and, scorning mountains, valleys and wilderness, have criss-crossed the country at varying speeds of a hundred miles an hour or so, on every conceivable kind of mission—from carrying freight to hunting moonshiners.

We have here tonight many of the gentlemen who, by their ability and unselfish devotion to the big idea, have placed America well in the lead in sporting aviation. The public has read thousands of columns about their daring exploits in the air—invariably conquering and overcoming all obstacles and successfully accomplishing their mission.

Public Confidence in Aircraft Necessary

All this has worked wonders for civilian aviation. It has given the public the confidence which it has sadly lacked—a confidence which it still lacks to a lesser degree, it is true, but the public confidence remains to be secured or won, nevertheless. And that is what we all are working for. That is one great result of gatherings such as this. They show the people that there are persons in large numbers who have faith in the flying machine.

Then there are the people who are doing the actual flying. They are converting the public.

There are more than 125 commercial aerial transport organizations in this country today. Some of them, it is true, are operating on a shoe string. Others are highly organized and supported by private subscription in expanding their service wherever conditions warrant

125 Organizations Operating in United States

These, we will say, 125 companies, are operating at least half of all the planes in use in this country, that is, among civilians. The other half are owned by persons using them for private purposes, or by the so-called gypsy pilot, who moves about the countryside much as the itinerant minstrel of old.

And the song of the gypsy pilot is the song of the air—he may earn a living or he may not, but he earns the gratitude of the American public just as the preacher and the schoolmaster a century ago earned a nation's gratitude by tramping from place to place, from town to town, moulding public opinion and stimulating thought and education among the great mass of people who live outside the centers of population.

For this is a broad country. The field is unlimited. The uses to which we have put the aeroplane are few compared to the uses to which we shall put it—after people learn to use it for all it's worth.

So, it will be seen, we are making progress in the air.

Now for some of the problems which we here tonight must face in developing commercial and civilian aviation.

Civilian Aviation Is the Great Defense Reserve

First of all, we must bear continually in mind that in dealing with civil aviation we also are dealing with our aeronautical reserve, the great third arm of our national defense. They are one and the same thing, civil aviation and national defense.

I have been a pilot. I believe I know the pilot and I hope that I do not underestimate his value to aviation. The aviator today is a being set apart from others. It is not unusual to hear him termed a god among men, and so on, with all the flowery encomiums that the great hero-loving public loves to shower on a person who qualifies for something that it does not quite understand.

We must not forget the pilot. But in our attention to him let us not forget the various agencies and persons that make it possible for the pilot to fly.

One hears very little about the mechanic, the designer, the engineer. One hears nothing about the executives who manage to provide enough money to meet their pay-rolls, and thereby keep the designer, engineer and the artisan on their respective jobs, experimenting, assembling, turning out machines that fly, planes that fly safely, and year by year with improvement over the machines that were made before.

Our Civilian Industry Must Be Maintained

We must maintain that organization with every means at our command. For it is the civilian aviation aeronautical industry which will provide our aircraft and develop and perfect it. We must maintain it not only for civilian purposes but for military emergencies.

We could do nothing in war without it. We would be far behind an enemy did we not possess an aircraft building industry capable of producing machines in performance and quantity the equal of any other nation. I say any other nation in all sincerity, because once at war we would find that our enemy would go into every market of the world for the best in planes and equipment.

We need an aircraft industry second to none. If we don't have it we are passing up our chief insurance against war and our chief protection if war should come.

And, mind you, that great important truth throws the aircraft industry directly into the arms of the Government. By that I do not mean to suggest or bid for subsidies; though it is a well known fact that every nation on earth is subsidizing its aircraft industry.

The Government Must Support Civil Aviation in Two Ways

Our Government must take cognizance of the need for this industry.

It must support it, legitimately in every conceivable way; and I am strongly of the opinion that there are two principal methods for the Government to act in this matter; and *act now!*

Build Government Aircraft in Civilian Plants

1. By adopting a policy wihch will take aircraft construction out of the arsenals. Remove the construction of aircraft from Government owned and Government operated factories and place that work where it will serve to maintain a reserve industry, helping to nourish it until by the increased use of civilian machines, our plants and factories, and our engineering establishments shall become self-supporting. It will be cheaper in the long run, and without added cost to the Government at present or in the future. The civilian aircraft builder can produce Government planes, designs and engineering facilities and equipment as reasonably, in fact, more economically than the Government. And that is the truth, borne out by figures which are available to every person who cares to investigate the truth of the statement.

Pass the Wadsworth-Hicks Bill Now in Congress

2. Then also, the Government must provide us with aerial law. Today aviation is technically an outlaw institution. We have no laws to protect it or control it. One can fly anything, anywhere, with nothing but his own judgment to guide him. The reckless pilot, the fool stunt flier, the conscienceless promoter of fake aerial enterprises—these people can claim to do anything that the best of us can do in the air—and get away with it. The man of conscience and desiring to abide by the law, protecting himself, his passengers and the property and persons of others on the ground, finds himself up against it because he has no laws to guide him, and no law to protect him.

We need aerial law, federal laws, telling us what we can and cannot do—licensing our planes and our pilots when they are proved airworthy and reasonably safe. We want some standing before the law. Give the men of the air an even break.

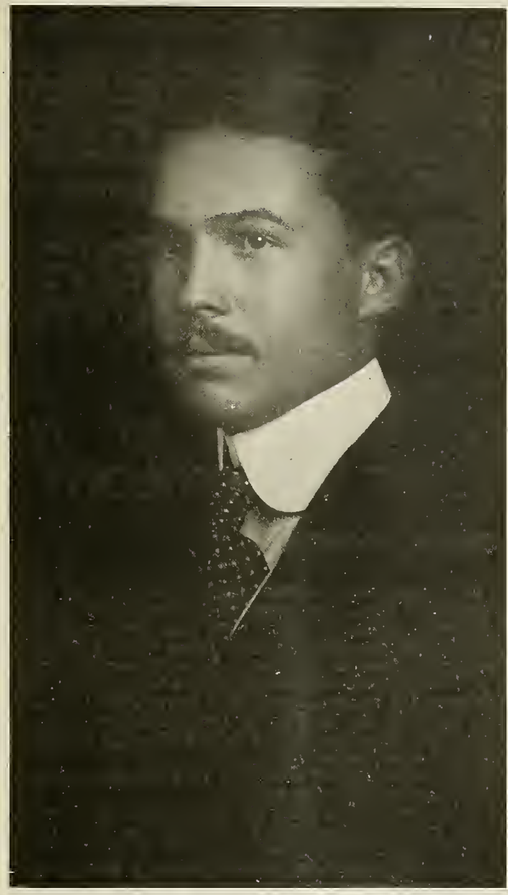
In view of this I call your attention to the Wadsworth-Hicks Bill, now before Committees of both Houses in Congress. It provides for a Bureau of Civil Aviation in the Department of Commerce, which shall license pilot and plane, administer the laws and supervise the development of civil flying. This bill should be passed immediately, as it embodies most comprehensive plans for eliminating many of the problems with which aviation is confronted.

Protect our pilots and give our aviation industry an even chance for its existence and we shall keep pace with other nations in the air.

Rear Admiral William A. Moffett, in charge of Naval Aviation, in the course of an admirable speech, endorsed heartily the sentiments of Admiral Fullam and Major General Patrick, and assured his auditors that the Bureau of Aeronautics of the Navy would co-operate in every way in the good work of the new club.

The Hon. Fred C. Hicks, member of Congress, and an ardent supporter of aeronautics, delivered a rousing speech, which was most cordially received. He assured his hearers that he would do everything within his power to put the United States in the position of world leadership in aeronautics, which was our prior right.

The motion pictures of the bombing experiments and landing



Grover C. Loening, winner of the Collier and Wright Trophies

of aeroplanes on the deck of vessels, which were described by Admiral Moffett and Capt. St. Clair Streett, were greatly enjoyed.

Following is a list of the guests present:

Gaetan Ajello, H. W. Alden, J. H. Anderson, F. Arcier, Vincent Astor.

C. R. Baines, E. H. Ballard, W. Barling, Lt. R. S. Barnaby, Luther K. Bell, W. N. Bennett, Lloyd Bertaud, S. R. Bertron, L. W. Bettiger, Jack Binns, Cortlandt Field Bishop, Gutzon Borglum, S. S. Bradley, Caleb S. Bragg and Guests, Sidney Brewster, George Royce Brown, H. R. Burt, Charles T. Bush, Jesse Butcher.

John R. Cautley, H. B. Childs, V. E. Clark, James Clausen, Howard E. Coffin, J. B. Coleman, C. B. Coombs, Capt. C. W. Connell, John W. Cox, Henry M. Crane, Hon. Benedict Crowell.

F. Trubee Davison, Charles H. Day, Capt. de Lavergne, Thomas Dixon, Ladislas D'Orcy, Capt. J. O. Donaldson, Nelson Doubleday, J. Dunn, Pierre S. du Pont.

T. J. Egan, Cleburne Eberhardt, Jr., Charles Jerome Edwards.

Snowden A. Fahnestock, Paul Fitzpatrick, A. G. Flachbar, A. H. Flint, A. Holland Forbes, Rear Admiral W. F. Fullam. E. F. Gallaudet, Charles W. Gardner, Dr. H. R. Gilhuly, W. L. Gilmore, Major Charles J. Glidden, Robert Graves, Harry Gray, Edwin Guggenheim, Harry Guggenheim, Lt. Col. A. Guidoni.

Capt. George W. Hamilton, Paul H. Hammond, J. L. Harkness, Edwin Harris, E. M. Haslam, Arthur C. Heldman, Brig. Gen. Nelson H. Henry, Walter J. Hewlett, Hon. Fred C. Hicks, Frank Hill, A. B. Hilton.

Frances T. Homer, L. S. Horner, George H. Houston, Richard F. Hoyt, Murray Hulbert, Miller R. Hutchinson.

G. Sumner Ireland.

Major General Mason M. Patrick, Head of the Army Air Service

J. W. Johnson, Joseph W. Jones.

Charles Keel, W. Wallace Kellett, E. A. Kelly, Col. F. R. Kelly, Gen. W. L. Kenley, Charles F. Kettering, C. M. Keys and guests, C. Roy Keys, Alexander Klemin, Theodore Knight, V. W. Kliesrath, Major Arnold Krogstad.

F. H. La Guardia, Gordon Lamont, John D. Larkin, Jr., William A. Larned, Harry Larsen, John M. Larsen, Edward J. Lavino, Charles L. Lawrence, W. B. Lebherz, Thomas J. Lewis, Earl J. Lomen, A. P. Loening, Grover C. Loening, Israel Ludlow.

The Genial Toastmaster Kettering

George Margolin, E. W. Marland, Howard Marmon, Walter Marmon, Samuel S. Mather, Burt McConnell, Donald McIlheny, Hugh D. McKay, Capt. McLaughlin, George J. Mead, G. Mejia, William Metzger, Howard L. Mingos, Rear Admiral W. A. Moffett, Ora J. Mulford, B. H. Mulvihill, T. E. Myers.

C. W. Nash, L. S. Neushal, George Newbold, Sidney Newborg, William W. Niles, Arthur Nutt.

S. O. Ochs, Everiste A. Orteig, Jules Orteig and guests, Raymond Orteig.

Arthur W. Page, Herbert Partridge, Major General Mason M. Patrick.

H. C. Pearson, C. G. Peterson, Stephen Philbin, T. S. P. Pierson, Roger Poor, Harold L. Pope, Augustus Post, George Post, Otto Praeger, J. L. Pratt, E. F. Price, George M. Pynchon.

F. B. Rentschler, Capt. Eddie Rickenbacker, Major James G. Rider, J. K. Robinson, Jr., William A. Rockefeller, John M. Rogers, F. Root and guest, Major D. E. Rowland, Lieut. John Roullot, Frank H. Russell.

Austin L. Sands, Howard A. Scholle, W. H. Schoonmaker, Alexander Seversky, Howard Sheaff, George D. Shallenberger, Col. E. H. Shaughnessy, E. Sikorsky, A. P. Sloan, Major Lorillard Spencer, Lawrence Sperry, Arthur N. Starin, E. F. Stewart, H. C. Storck, Eddie Stinson, William B. Stout, Capt. St. Clair Streett, Com. Strong, Donald O. Stuart, Father John Sullivan, Norman S. Swan, Fabian Swanson.

H. E. Talbott, Jr., B. D. Thomas, Edwin L. Thomas, W. D. Tipton.

Raymond B. Uber, Rex Uden.

Jesse G. Vincent, Joseph Van Vleck, Jr., Harry Vissering.

Sidney Waldon, P. N. Walters, G. Douglas Wardrop, Raymond Ware, George Henry Warren, Jr., Richard Watkins, Major W. R. Weaver, C. W. Webster, George S. Wheat, E. C. Whitbeck, W. S. Whittaker, Rushmore Wood, J. W. Woodrow, Capt. Burdette Wright, Robert Wright.

THE NEW FOUR-FOOT WIND TUNNEL AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

By WILLIAM H. MILLER and JOHN R. MARKHAM

DURING the month of August of the current year, the construction of two new wind tunnels was begun at the Massachusetts Institute of Technology; one having the experimental chamber four feet in diameter, the other a diameter of seven and one-half feet. The smaller of these tunnels, the four-foot, is now in operation. It replaces the four-foot N.P.L. type tunnel constructed at the Institute in 1913 under the supervision of Commander J. C. Hunsaker.

The present tunnel was designed and constructed under the supervision of Professor Edward P. Warner of the department of Aeronautical Engineering, with the assistance of the writers.

The four-foot wind tunnel (as well as the larger one) is of venturi type with an overall length of 42 feet, thus having a length-diameter ratio of 10.5. It is of circular cross section throughout. The intake bell (or entrance cone) has a length of 11 ft. 6 ins. with a mouth diameter of 9 ft. 6 ins. Its surface is generated by revolving an ellipse of semi-minor and semi-major axes, 2 ft. 9 ins. and 11 ft. 6 ins. respectively, about the tunnel axis.

The throat comprising the experimental chamber is of cylindrical form, 4 ft. in diameter and 6 feet long.

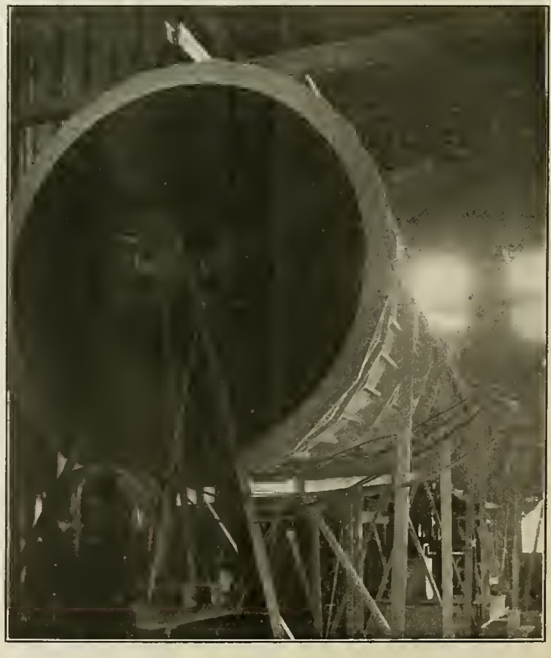
The exit cone is of the straight type having a length of 24 ft. 6 ins. and a diameter of 7 ft. 9¾ ins. at the large end. The cone is faired to the experimental chamber by giving the surface near the experimental chamber a slight curvature. The vertex angle is approximately 9°. The complete wind tunnel is supported on steel struts of angle iron attached to the footing of the old tunnel. A special type of bracing is used which is designed to relieve the tunnel as much as possible of longitudinal tension and compression. The complete tube was built on the ground in three sections; intake bell, experimental chamber and exit cone. The frame work of the intake bell and exit cone, alike, consists of built-up circular rings notched to carry 32 longitudinal slats. The rings are constructed of ⅞ in. x 8 in. whitewood stock. The exit cone slats are straight 2½ in. x ⅞ in. whitewood, while the curved slats of the entrance cone are twice the thickness of those in the exit cone and are laminated. The entrance cone is lined with a high grade of plaster of thickness 1½ in., reinforced with heavy steel lath. A revolving template was used in the final moulding of the inner surface. The plaster was backed up on the outside and troweled to a smooth finish between slats.

The exit cone is lined with 3/32 in. three-ply birch veneer which is nailed to both slats and rings.

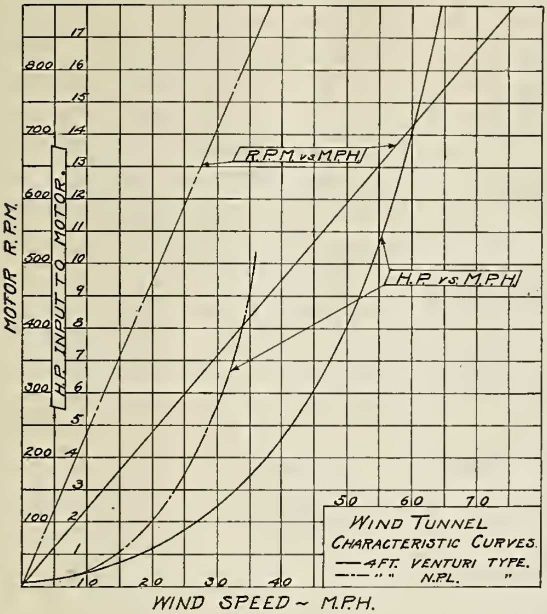
As it is necessary to have the experimental chamber quite rigid and capable of carrying considerable load, it was built up of ⅞ in. x 1½ in. lap joint whitewood stock nailed to circular rings. The experimental chamber has a large glass door on the side and a glass window on the top for aligning models and apparatus. There is also a large removable bulkhead in the floor.

The slightly remodeled honeycomb of the old tunnel is in

Side view M. I. T. 4 ft. Wind Tunnel



Exit cone end M. I. T. 4 ft. Wind Tunnel



use at present. It is built up of circular tubes of thin-gaged sheet metal, three inches in diameter and eighteen inches long; and is placed in the forward end of the experimental chamber 37 inches from the balance spindle. Although this distance between honeycomb and model is considerably less than is usually used, the flow is unusually steady and the agreement between results of the old and new tunnels remarkably close. The chief disadvantage of such a location of the honeycomb, however, is in its poor economy from a standpoint of power. It appears that in the tunnels of the venturi type the efficiency can be substantially improved by using a honeycomb of larger overall circumference located near the mouth of the entrance cone.

The original power equipment of the old tunnel has been retained. A 12 K.W. direct-current generator driven by a 15 H.P. induction motor supplies current to a 10 H.P. direct-current motor driving the propeller through a chain belt. A new propeller having a diameter of 7½ feet and of variable pitch has been installed.

The power curves for the old and new tunnels are shown in the accompanying graph. Despite the fact that the motor is somewhat heavily overloaded, it is possible to obtain a maximum speed of 65 m.p.h. A speed of 60 m.p.h. it is observed can be obtained with 40% overload of the motor.

The efficiency of the motor-fan-tube unit is given by*

$$\eta = \frac{K.E.}{K.E. + E_s}$$

Entrance cone M. I. T. 4 ft. Wind Tunnel

where K. E. is the kinetic energy in the throat and E_s is the energy supplied from external sources. Using horsepower units

$$K.E. = \tfrac{1}{2} \times \rho/g \times \frac{AV^3}{550}$$

where A is the cross section area and V the velocity in the throat in ft. per second. The mass density ρ/g is equal to .00237 for standard air. E_s is the horsepower input to the motor. The normal velocities in the old and new tunnels are respectively 30 and 60 m.p.h. The respective overall efficiencies are therefore 32.5% and 56.7%, as can be easily verified by means of the power curves given.

The original N.P.L. type aerodynamic balance is in use at present. A new balance, however, is under construction. The wind speed is obtained by means of a Krell manometer connected to a static opening in the throat. The manometer was calibrated in the usual manner, by means of a pitot tube and Chattock gage.**

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* This definition of the overall efficiency of a wind tunnel is due to William H. Miller, graduate assistant in Aeronautical Engineering.

** "The Wind Tunnel of the Massachusetts Institute of Technology," by J. C. Hunsaker, in "Reports on Wind Tunnel Experiments in Aerodynamics," Smithsonian Miscellaneous Collections, Vol. 62, No. 4, pages 1-15.

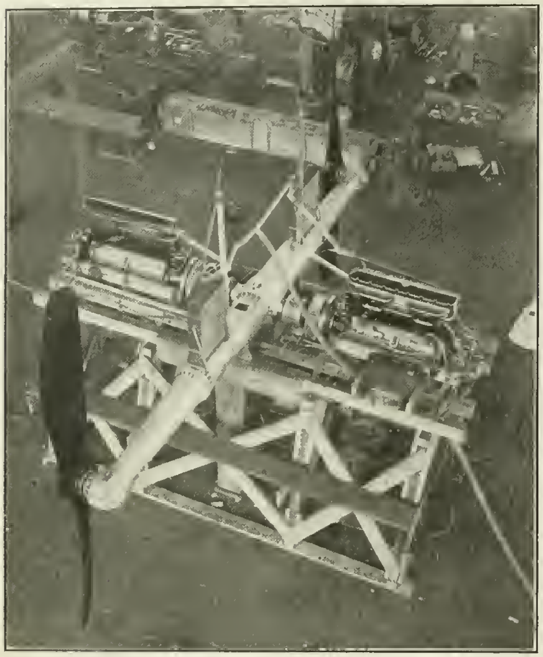
GOODYEAR GEAR-DRIVEN AIRSHIP

By H. T. KRAFT

Chief Aero Engr. the Goodyear Tire & Rubber Co.

THE envelope of the new Military Airship being built for the U. S. Army is of the Pony Blimp shape, having an aspect ratio of 3.6 to 1. While there has been considerable question as to the head resistance of a large diameter ship, the entire absence of tail droop and the maintenance of a perfect stream-lined shape on non-rigid ships, are items which are usually overlooked, and are important factors in reduction of resistance of an envelope, apart from the fact that there is a tremendous reduction in skin friction due to the short length of the hull. From a dynamic standpoint, ships of a short aspect ratio have been considered somewhat unstable, but there again, the high static stability due to the low center of weights, of course, is not represented in wind tunnel tests on the model of the envelope itself, and a ship of this type should be equally as stable in view of this condition as any airship of this capacity built in the past. The envelope and the car are faired together with an elastic fabric immediately below the envelope, making the entire ship a well streamlined body.

There is a tremendous saving in surface weights of the envelope proper, in this particular unit reducing our weights over 1,000 pounds. With that, of course, goes the reduction in diffusion, which should be about one-sixth less than ships built in the past of the same capacity. There should be no surging of the ballonet, due to its particular design, wherein



Gear Arrangement of Goodyear Airship

the base line attachment to the envelope is greater than its lateral area, it being impossible for the ballonet to travel beyond this fore and aft base attachment point.

The car is of the enclosed type, with two longitudinal sills 18 inches deep which constitute the backbone or principal strengthening members of the structure. The balance of the car is simply a shell, housing the crew, and permitting a closed car to be built of approximately the same weight as any open type of car constructed in the past. While the development of airships in the past has necessitated the adoption of various instruments, they were usually attached as an afterthought in a rather makeshift arrangement, but before attempting the construction of this unit, we formulated plans so that the control of the airship would be entirely unified. The control board carries every instrument that is required for successful lighter-than-air navigation, and is set in the car in such a manner as to permit all instruments to have the highest degree of accessibility. The pilot controls the entire transmission, clutches, reverse device, etc., from the navigating cabin. The engineer is located in a separate cabin to the rear of the car, with an instrument board for reading all pressures and temperatures of the motors and transmission assembly. The mufflers are of the dual type, in which a part of the air which is delivered to the ballonet is circulated around the exhaust chamber and then into the exhaust itself, to assist in muffling the exhaust noises.

Water ballast is carried in the floor of the car immediately below the navigating cabin, wherin a dial is located to indicate the amount of water available for ballast. The fuel tanks are located in the rear part of the navigating cabin, in two 160-gallon tanks, so constructed as to permit them to be used as sleeping cots in case of long flights. Provisions are made for a crew of seven.

It will be noted that all suspension cables run to the floor of the car, thus permitting veneer sides of 3/32" thickness to be used. As all loads are concentrated at the floor line, the surge of the car while in flight is resisted by two lateral cables and four longitudinal cables attached to the center bulkhead. This, in addition to martingales which are also attached to the floor line, has proven very successful in overcoming the surging fore and aft such as is usually experienced when a car is hung too far away from the hull. The disposable load is located directly under the center of volume of the ballonet, thereby permitting a single ballonet to be used, without any possibility of getting out of trim, irrespective of the loads carried within the car.

In going over all the data we could secure on transmissions built in the past, we well realized the problem that confronted us as there had been so many failures along this line. The outstanding difficulties that were experienced with transmissions built in the past were heating up of the oil and excessive vibrations due to torsional reactions, also the transmission getting out of step with the motors, causing excessive gear noise. It, of course, was our thought to design a transmission that would be entirely free from these defects. In closely scrutinizing the construction of other gear drives, we found that the principal defects were the entire lack of unit construction, wherein the designer depended upon struts or other connections to the car or fuselage, and in the case of aeroplanes, attachments to the wing struts, which, of course, made it quite obvious that trouble would be encountered.

In laying our plans for the Goodyear transmission, our first thought was to make the entire assembly one integral unit, wherein the clutches, couplings, gears, shafts and propeller gear housing would be built together in the most direct manner. It was largely on this basis that the success of the transmission was assured. We next analyzed the gears of several different types of transmission and found that the tooth profile was bad, and in view of using straight bevel, trouble was experienced in perfect citting of the teeth, which resulted in excessive gear noises.

The Goodyear transmission was designed with spiral bevel gears in which considerable experience was available, in view of their popular use in the automobile industry. The teeth were 4-5 pitch 30 degrees tooth angle, and were made by the Gleason Gear Works of Rochester, N. Y. We found that in making the preliminary test run on a dynamometer that there was an entire absence of gear hum, and while this dynamometer test forced us to allow two gears to idle in the case, we experienced very little heating up. To get an absolute percentage of efficiency of this unit, in the airship itself, we constructed a large wooden stand upon which were mounted two Aeromarine 135 h.p. type U-6-D motors, connected thereto being two clutches of the multiple disc type, manufactured by the Twin Disc Clutch Company of Racine, Wisconsin. Couplings between the clutches and the transmission were of the flexible type so designed as to take some degree of misalignment and angularity.

While theoretically this unit is in perfect alignment, the couplings were inserted to absorb any misalignment that might occur due to the weaving of the car proper. The transmission tube which is one complete unit is held on the cross sills by eight bolts at the outer edge of the car. A test load of 1,000 lbs. was hung on the propeller tip with a deflection of only 0.098. We were thus assured that a propeller which weighs

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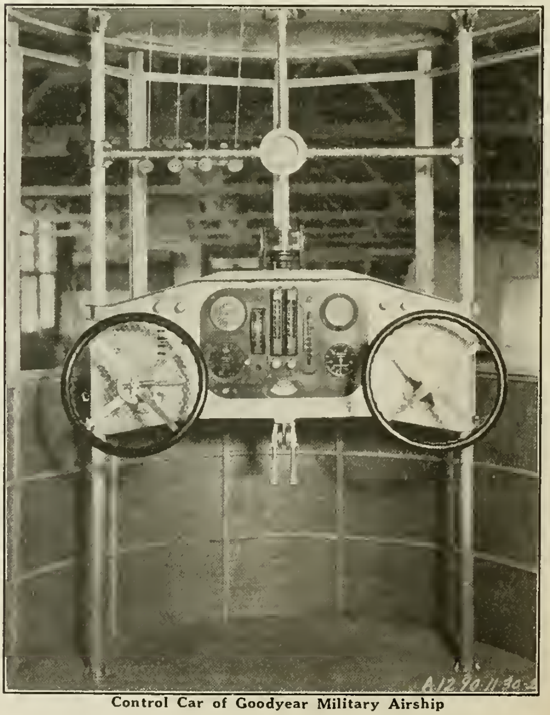
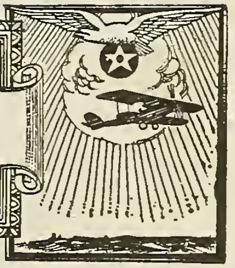


Control Car of Goodyear Military Airship

NAVAL *and* MILITARY AERONAUTICS



Booming Army Aviation

To interest young men in the Air Service of the United States Army, Lieut. E. H. Barksdale with an aeroplane from Mitchel Field, Mineola, "bombed" the lower part of New York recently with pamphlets containing information concerning Uncle Sam's aviation forces. Lieut. Barksdale was accompanied by an observer.

The aeroplane, flying at a height of 3,000 feet, circled the Woolworth, Singer, Pulitzer and other buildings. It then headed north and circled Grant's Tomb. Crowds scrambled for the pamphlets as they landed. Other flights will be made.

Rockaway Naval Station

Application of the Navy Department for a grant by New York city to the Federal Government of about 150 acres of Jacob A. Riis Park at Rockaway Point for use as an air station was formally withdrawn at a meeting of the Sinking Fund Commission. Opposition to the project had mustered a formidable gathering to fight it.

The city agreed to permit the navy to continue the use of some ninety-five acres of the ground it now occupies for six months. If the Department wants the land longer it may renew the application. Murray Hulbert, Aldermanic President, who had favored the project when he was Dock Commissioner, made the suggestion that the application be withdrawn. He said he had been surprised to learn in Washington a few weeks ago that the Naval Committee of neither the House nor the Senate was aware of the project.

The Navy Catapult

In addition to carrying aircraft on special vessels known as aircraft carriers, it is anticipated that fighting and spotting planes may in future be carried on battleships and cruisers, although it is clearly impossible to provide these ships with the flush deck as in the case of the carriers. To permit the launching of aeroplanes from a battleship or other war vessel, the catapult has been resorted to, and a special type of catapult has been developed at the Philadelphia Navy Yard which has been designated a turntable catapult because the catapult mechanism proper is mounted on a turntable so that it can be pointed into the wind when launching a plane. One catapult of this type could be installed on every battleship and could launch when needed a fighting aeroplane, so that a fleet of battleships would be able upon the approach of hostile bombing aeroplanes to send into the air instantly a large number of fighting planes to shoot them down before the bombing attack could be developed. This is the real answer to the threat of the bombing plane, which was demonstrated in so spectacular a manner by the recent bombing from the air of the ex-German warships.

In the bombing attacks of these ex-German warships it was shown that bombs dropped from the air could do material damage to warships which did not defend themselves. Obviously a warship can defend itself by anti-aircraft gunfire, but better by attack in the air. The weapons of offense and defense in the history of naval warfare have always developed step by step, and the development of the heavy bombing aeroplane is being met by this development of a catapult which will shoot fast combat planes from the decks of battleships into the air to repel bombing attacks.

The catapult of this particular type is new, but the elements are the result of Navy catapult development initiated in 1911 by Captain Washington I. Chambers, at that time in charge of Naval Aviation experiments. The first flight was made November 12, 1912, by Commander, then Lieutenant, T. G. Ellyson in a Curtiss seaplane from a catapult. This early catapult was highly experimental, and while the first flights were successful, the device was not entirely satisfactory. The matter was resumed in 1915, when the development of Naval seaplanes had proceeded to such a point that it was clear to the Navy it would be desirable to take aircraft to sea. A new design of catapult, based on experience with the first one, was installed on the stern of the armored cruiser "North Carolina," and successful flights were made. The "North Carolina" installation proved so reliable that similar catapults were installed on the armored cruisers "Seattle" and "Huntington," and during the early winter of 1916 successful flights were made from these cruisers. At the time the United States entered the war the principal Naval effort was anti-submarine in its object and the convoy of shipping. Aircraft were not needed aboard these cruisers for this purpose, and the catapults were removed. After the armistice the catapult problem was again taken up and a catapult, similar to the "North Carolina" design, which had been in use at Pensacola for training aviators while mounted on a coal barge, was brought to Washington and further tests and investigations made. The result of this investigation led to the design of the present turntable type of catapult, which has now been completed at the Philadelphia Navy Yard and mounted on the water front for practical testing with aircraft.

The old catapults, such as were used on the "North Carolina," consisted of a track along which a carriage was propelled by a compressed air cylinder. The aeroplane was mounted on this carriage, and as the carriage speeded up it released the aeroplane at the end of its run, allowing it to fly into the air. The track for this catapult was mounted along the center-line of the ship, and since it was necessary to launch the aeroplane direct into the relative wind, it was necessary for the ship to set herself on such a course that the wind blew in the direction of the catapult track. This maneuver, while entirely feasible, necessitated the ship turning out of formation, or heading upon some course which might prove very disadvantageous. For a battleship it is considered impossible to require the ship to leave formation and to head upon a course which is possibly of great tactical disadvantage only for the purpose of launching a plane. These considerations led to the development of the turntable catapult, which permits the ship to proceed upon its usual course in formation while the catapult is trained like a turret into the relative wind.

The turntable catapult consists of a bridge-like structure mounted on a turntable upon which there is the usual car which carries the aeroplane, and this car is propelled by compressed air. Frequent tests have demonstrated that it is possible to launch by such a mechanism any of the types of aeroplane or seaplane which would be carried upon a battleship.

The problem of launching an aeroplane in a short run by means of the catapult depends upon several factors. The first and primary one is, of course, that at the end of the run the catapult should have given the plane a speed such that when the plane is released from the car the wings will lift it into the air and flight has begun. This requires that the launching velocity shall be *somewhat in excess of the minimum flying speed of the plane.* Second, it is necessary while the plane is being brought up to this flying speed that the plane be held securely to the launching carriage in order that it will not leave the track too soon. Finally, it is necessary that the acceleration of launching shall not be so great or so violent as to injure the pilot, who must ride in the plane and preserve all his senses alert in order to take charge as soon as he is released at the end of the run.

The development of a successful catapult to accomplish these desired things is believed to mark an important step in providing our fleet with aircraft, and with these turntable catapults, which are relatively small and compact, it is possible to provide the individual vessels of the fleet either with aeroplanes which can be launched from catapults when desired, but which will land upon an aircraft carrier when their mission is completed or, alternatively, the warship may carry seaplanes which can be launched from the catapult in a similar manner, but which will land upon the surface of the sea and be hoisted aboard like a ship's boat. Until such time as the Navy is provided with a suitable number of aircraft carriers it will be necessary to use seaplanes for work with the fleet. Under many conditions the seaplane in its present state of development is entirely practical, although in very rough weather a landing upon the sea is likely to mean the damage if not the loss of the seaplane, although it is to be expected that the aviator can be rescued. The conditions of the weather, however, are not believed to offer any inconvenience to launching by means of the catapult, and in time of war the commander-in-chief will launch his planes in the air where they may accomplish their mission regardless of whether or not the planes may be salvaged intact upon their landing.—*Scientific American.*

FOREIGN NEWS

The French Air Routes

Some very interesting figures relating to the progress made by the French aerial routes have been issued by the French Under-Secretariat of State for Posts and Telegraphs. These figures disclose that, taking the twelve months from October, 1920, to October, 1921, the mail traffic on the London-Paris route has steadily diminished in volume. In October of last year 3,005 postal packets were carried, while in the corresponding month of 1921 this number had fallen to 1,923. It may be remarked that it is quite possible that a good deal of this decrease is due to the fact that regular British lines are running and are obtaining their share of the mail traffic. Nevertheless, the figures are somewhat curious, the more so as we find the same conditions affecting other French lines, which are not subject to outside competition. The Paris-Brussels service shows an astonishing falling-off, only 71 letters being carried last October, as against 621 in the corresponding month of 1920. Paris-Amsterdam shows a decrease from 176 in May last to 35 in October, while the figures of Paris-Strasburg fell from 115 letters in October, 1920, to 64 in October last.

On the other side of the picture, we find that Paris-Prague rose from 138 packets of mail in 1920 to 863 in October of this year. The Paris-Warsaw route, opened in May last, carried 344 letters in that month against 877 in October. A really wonderful result is shown by the route Toulouse-Casablanca. In October of last year this service carried, out and home, 24,349 postal packets, and in the corresponding month of 1921 this total had increased to 40,607. During the whole year no fewer than 306,181 letters were carried by this service, Paris-London coming next with 28,534.

The deduction to be drawn from these figures seems to be that the business community does not attach a great deal of importance to the saving of a few hours on the shorter aerial routes, but that where the saving of time amounts to days, as it does in the case of the Toulouse-Casablanca route (by which five days are saved in comparison with train and steamer), there is a rush to take advantage of the facilities afforded by the aerial post. The figures are more than a little interesting, and can, we think, be studied with advantage by our own postal authorities, who seem dubious as to the advantage or otherwise of using aerial communications to the more distant parts of the Empire. The way they appeal to us is that they prove that the longer the distance over which aerial conveyance is used the more rapid the growth of the traffic and the more successful the enterprise must be.—*Flight.*

Commercial Aviation in Algeria

In a report just to hand, by the British Consul-General at Algiers, it appears that the Algerian Assemblies have approved the inscription in the 1922 Budget of a credit of one million francs for the purpose of subsidizing certain aerial services, the proposal being that Paris, Marseilles and Algiers should be connected by an airship service and that aeroplane services should be established betweeen Algiers and Biska, and Algiers and Casablanca, respectively. The exploitation would be in the hands of private companies, who would have to fulfill certain obligations with a view to the immediate adaptation of their organizations to war purposes if required.

The construction of an aviation center with two hangars at Baraki, near Algiers, is contemplated.

Very shortly an experimental voyage between Marseilles and Algiers is to be undertaken in the "Nordstern," a German dirigible which has been delivered to the French authorities. It is expected that the service will be in operation next year, that the journey from Paris to Algiers will occupy between 16 and 20 hours, and that the cost will not be more than 1,000 francs a head.

French Air Line Expansion

From Paris it is reported that among the extensions planned by French air line companies during the coming year is the extension by the Compagnie Messageries Aériennes of their London-Paris service to Marseilles. At present Paris is not linked up by air to the south of France, travelers having to proceed to Toulouse by train. If the new line is established it should make a very considerable reduction in the time taken to get to the Riviera via Marseilles. It will also link up with the Latécoère lines to Morocco.

The Michelin Cup

December 31st is the finishing date on which competitors may attempt the flight around France for the Michelin Cup. Unless a French pilot manages to put up an exceptionally fine flight before that date, the cup will remain in Italian hands for the coming year. At present Martinetti has done the best time over a 3,000 km. circuit, having covered the distance in 35 hrs. 45 min. elapsed time. On December 21st Major Vuillemin made a plucky attempt to beat Martinetti's performance, but partly owing to fog and adverse weather conditions he had to abandon the attempt after having covered a little more than half of the 3,000 km. course.

Italian Government Encourage Aircraft Firms

As a result of the Italian Minister of War's program for civil aviation, many orders are, it is stated, about to placed for new machines. They include the following:

Fiat.—Two AL machines, two three-engine machines for 12 passengers and two Deutsk-type machines. The first two machines to carry six passengers each.

Ansaldo.—Two 300C biplanes and two 300T biplanes.

Macchi.—Two M.18 cabin machines with IF V6 engines, two M.18 economical-type machines with IF V6 engines and two M.20 with Anzani 45 h.p. engines.

S.*I.A.I*—Two S.13 bis, two S.16 and two S.16 bis machines.

Caproni.—Two biplanes 1921 type, 450 h.p. engine.

Orders will also be placed with the Breda Works.

All these machines will be at the disposal of their constructors for competition purposes, but they must be in the hands of the Technical Directorate in two years.

Gordon-Bennett Balloon Race, 1922

Alteration No. 1: It is now announced that the above contest will start from Geneva on August 6th, instead of September 2nd.

The Oscilloscope

The instrument known by this strange name was developed during the war at the Royal Aircraft Establishment, Farnborough, by Mr. A. J. H. Elverson, more especially for the investigation of some of the many problems connected with vibrations which occur on or about aero engines. It is understood to have given very valuable and informative results in regard to these matters and to be in use for that purpose at the present moment.

The instrument has now been put on the market by The Oscilloscope Syndicate, Ltd., care Herbert Kennedy and Co., 70, Fenchurch Street, E.C.3, and should serve many useful purposes in all branches of engineering.

The Oscilloscope is a form of Stroboscopic apparatus and in its general effects it may be said to be virtually an optical gear ratio. By its use high-speed machinery of all kinds can be observed and the actual working of the mechanical parts seen *under working conditions,* apparently running at a predetermined fraction of the true running speed at the moment. In general practice it has been found that an optical gear ratio of 1 to 100 is very convenient, but in special cases, such as direct-driven airscrews and very large high-speed machinery, an optical gear ratio of, say, 1 to 1,000 is more convenient and can easily be adopted.

The instrument is rigidly connected to and driven by the machinery under consideration, and the parts thereof to be examined are illuminated by a special form of electric lamp controlled by the instrument. Such parts thus illuminated will then appear to be going through their normal cycle of operations, but at a reduced speed, say, of 1 to 100.

In this way systematic faulty running at any point of the cycle of operations will at once be apparent, and these objectionable features will probably be even more apparent at certain critical speeds. It should here be noted that the nature of the motion under observation is immaterial and may be either rectilinear or rotary or any other form of motion.

Above and beyond this, it is also possible with this instrument to make the mechanism under consideration to appear to be stationary at any given point of its cycle of operation and thus to observe inaccuracies of operation at leisure. Thus it will be seen that not only can fundamental inaccuracies in operation due to faulty design be seen, but also by observation in an apparently stationary position temporary aberrations from normal working at that particular point of the cycle of operations can be detected.

Special arrangements are made to enable actual measurements to be made with considerable accuracy of any movements under observation, both in rectilinear dimensions and angular displacement, and thus it is possible with this instrument to plot, for instance, the actual valve diagram on an internal combustion engine under working conditions and afterwards to compare it with the designed valve diagram and from this comparison to get a very true idea of the effects of time lag, inertia, etc.

It will readily be seen that questions of vibration are thus very simply, rapidly and accurately dealt with, and it is possible to find the periodicity of any vibration with relation to any given shaft of the mechanism under consideration, without any calculation whatever. This is done by increasing the number of illuminating flashes per revolution, this number being gradually increased until a double image of the vibration is obtained. Under these conditions it is at once known that the periodicity of the vibration with relation to the driving shaft is half the number of illuminative flashes given per revolution.

There are many other applications of the instrument in several other fields, and it has been found that it is not difficult to use the same general process in connection with location of mechanical noises in machinery and not only to locate their position, but also their angular locus in the normal cycle of operations. This opens a very large field for further investigation, and is of immense use in many problems in all branches of engineering.

The great feature of the Oscilloscope is that it reveals things as they really are *under actual working conditions,* and is independent of such unreal things as mathematical rigidity, for instance, which are the fundamental reasons for the statement that all engineering is a succession of more or less inadequate compromises.

Mapping From the Air

Mr. B. Melville Jones, Professor of Aeronautics, Cambridge University, in a letter to the *Times* states that the Royal Air Force has placed at the disposal of the Engineering Laboratory a small experimental flight of aeroplanes working from an aerodrome in the neighborhood of Cambridge. The work is being carried on under the direction of Mr. Melville Jones with the close co-operation of the Department of Geography at Cambridge, and with the personal assistance and advice of Capt. H. H. Thomas, who is a member of the University and a former Air Force officer intimately connected with aerial surveying in Palestine.

Mr. Melville Jones is also in touch with the War Office Air Survey Committee and with the Photographic Department of the Air Ministry. The bulk of the work is being carried out by two research assistants financed by the Department of Scientific and Industrial Research.

In reply to his letter Comdr. Boothby, R.N., states that many of the difficulties of surveying would be overcome if airships were used instead of aeroplanes.

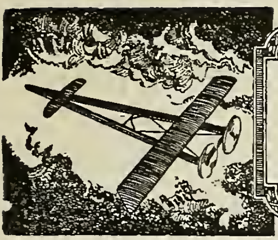
London-Cork Service

Plans for an air service between London and Cork that would shorten the journey to America by at least a day are being prepared. The distance from London to Cork is 400 miles and a modern commercial aeroplane could accomplish the journey in four hours.

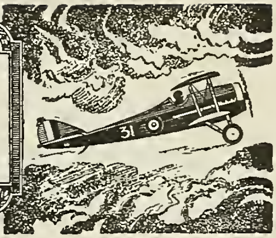
Passengers and mails could leave London the day following the departure of a liner and catch up with the boat at Queenstown Harbor, while incoming mails and passengers would leave the ship at Queenstown and after four hours air journey arrive in London a day earlier than is now possible.

Aviators Employed to Prevent Drug Smuggling

Aviation was impressed into service in Honolulu recently by federal authorities in their endeavors to eliminate the smuggling of opium. A naval seaplane followed the liner Hoosier State out of port for a considerable time to prevent contraband narcotic from being dropped overboard and picked up by a small sampan, which is the method usually followed by the smugglers, federal authorities said.



ELEMENTARY AERONAUTICS *and* MODEL NOTES



The General Design of Model Aeroplanes

(Concluded from last week's issue.)

THE matter of aspect ratio is an open question and a ratio anywhere from 4 to 9 can be used to advantage. Considering weight as of chief importance, a ratio of about 5 will give good results. From a lift-to-drift standpoint the aspect ratio should be high. The more common ratios are from 6 to 7.

For distance flying an important item to notice in the construction of a model is that both propellers of a twin propeller model are of the same pitch and revolve at exactly the same speed. Otherwise the model will tend to do a "figure 8." Rigid wings aid in the securing of good adjustment for straight flying.

Altitude Attained

While meets for altitude are difficult to hold, it is important that any model aspiring to good performance be able to climb to a reasonable altitude. In order to do this the model should have more power than necessary at the beginning of the flight in order to level out when the power diminishes—as it does soon after the start.

The largest factor in the climbing ability of a model besides the question of surplus power is the question of propeller diameter. A formula for propeller diameter which may be used to find the minimum diameter allowable is as follows:

$$\text{Inches Diameter} = 200\sqrt{\frac{1\ \text{Thrust (oz.)}}{\text{Flying Speed}}}$$

A diameter which is greater than the one given by this formula will be sufficient to give a good climb without greatly overpowering the model.

Quick Climbing

A model suitable for quick climbing should be one with large propellers and an abundance of power. Usually it is not the long duration or distance machines which have the greatest climbing ability but the ones with more released power than is necessary to furnish a reasonable high and consistent flight with a good glide at the finish.

For a quick climbing R. O. G. or hydro, the model should be set at rather a high angle in order that it assume its proper climbing angle from the start. An angle of six or seven degrees usually suffices.

Workmanship

Workmanship enters into the performance of every machine in that it shows the care that has been used in carrying out the details of design and construction. Any model builder who will take the pains to carefully construct each detail will not find it difficult to soon realize on that added time spent in getting superior results. The flying qualities of a model depend largely upon its weight, and a little saving in this respect here and there soon adds up to a large saving. So with the troubles experienced on the flying field. A careful builder is seldom handicapped by joints coming loose, rubber slipping off the hooks and such similar accidents. He sees that all of these little details are properly attended to when the model is built and he is then ready to fly when it is flying time and he does not have to rebuild his machine between each flight.

It is the attention paid to these small details which distinguish the reliable and consistent flying models, but I do not want anyone to think that accidents can be entirely avoided, because there will always at some time be something to fail. Do not, however, be discouraged by a smashed machine or two, but learn from each one and build the next one better.

Nature and Formation of Clouds

As clouds and mist are a real obstacle to the aviator, some notes on their composition and formation may interest students of the problems relating to flight. The atmosphere contains a certain amount of water vapor which is carried in solution similar to the manner in which salt may be dissolved in water. Hot water will dissolve more salt than cold water. If a hot "saturated solution" of salt be cooled, the crystals of salt will be deposited. In the case of a solution of water in air, the same effects are seen. Water is more readily soluble in warm air. By successively cooling air containing water vapor, the saturation point (sometimes called the dew point) is reached. If the air then be further cooled, small drops are deposited in the form of mist. Clouds consist of masses of mist formed in that manner.

The quantity of water which air will dissolve varies considerably with the temperature. For example, a variation of 30 degrees F. in temperature will multiply three times the amount of water which the air will dissolve. From this it will be observed that slight changes in temperature will cause the formation of clouds. Rain occurs when cooling takes place beyond the saturation point, causing particles of water to be formed which are too heavy to be held in suspension.

The highest fleecy white clouds, which are above the level of normal flight, consist of ice crystals due to the low temperature at the level of their formation. The lower clouds usually met with by the aviator may be grouped as "sheet clouds" or "heap clouds". The sheet clouds result from the stratified nature of the atmosphere. Layers of warm air coming in contact with cooler layers, become cooled also below their saturation temperature, a cloud being formed at the surface of contact. The cloud layer may be continuous or consist of isolated clouds. Heap clouds are formed by rising air current which become successively cooled as they rise.

The Scientific Value of Wind Tunnels

Wind tunnels, which produce for small models conditions paralleling those of flight, and provide for the prediction of the performance of an aeroplane as a whole, or the efficiency of any part of it, are becoming of increasing scientific value. In the Curtiss Laboratory one hundred percent results have been obtained in foretelling the general behavior of aircraft. The wind tunnel work has been under Dr. J. G. Coffin, Assistant Director of Research and formerly Associate Professor of Physics in the College of the City of New York. A graduate of the Massachusetts Institute of Technology, Dr. Coffin has given his attention to the intensive study of aerodynamical problems, and under his direction the Curtiss Model Shop has developed to a high point of efficiency.

Here aeroplane models and models of aeroplane elements are made by skilled craftsmen for wind tunnel use. Varying in span from a foot to three feet these miniature aeroplanes, wrought in mahogany and aluminum, are accurate to thousandths of an inch. Built to the engineering designs for a contemplated machine they are set up in the experimental chamber of the wind tunnel upon a spindle connected with a specially designed balance below.

The speed of the air which is drawn past the model is determined by the action of a propeller driven by a four-hundred horsepower motor. This motor is electrically controlled from the experimental chamber, and can furnish any speed desired, even to velocities approaching one hundred miles an hour. These speeds are accurately measured by means of a new type of absolute pressure gauge.

The balance can record wind pressures in all desired directions, to .0001 of a pound. Results are thus obtained which are the basis for almost any problem relating to the efficiency of aircraft. Shapes of wings can be tested for lifting capacity and for "parasite" resistance. The efficiency of a fuselage shape can be determined. Stability, head resistance, action of rudder and elevator, behavior of streamline wires, air-driven gasoline pumps, etc., are no longer matters of doubt for they can be settled in the laboratory previously to any field work.

Thus, the aeroplane has been reduced to a problem like a railroad bridge, and solved in laboratory and factory preliminary to its first actual use.

To Loop or Not to Loop

(With most abject apologies to W. S.)

To loop, or not to loop,—that is the question:
Whether 'tis better in the mind to suffer
The slings and arrows of outrageous kidding,
Or to take arms against this innuendo,
And now by looping end it?
To loop! Right now!
They say Hispanos won't run upside-down:
Suppose she conks before I reach the top,—
Stalls; slips; does flat turns on her back;
Then falls off, dives or spins!
To try a loop,—
To stall! To stall,—to spin! Ay, there's the rub,
For in that spin what ills may lurk! That breathless
Drop; that dizzying swing; the buffets of
The mad wind's hand! It makes my flesh to creep;
My vital stream runs cold!
And that were not enough
How she does hate to come out of a dive;—
How long it seems before she lifts, and then
With what a fearful suddenness;—her wings
Flex upward—Oooh-h-h! And if they hold not—Well!
To loop? Not me! To loop—to stall: to stall
Perchance to spin; and then to bring her out
Too swiftly,—knock her wings off: crash.
Oh, no. I think not. This is good enough
For me. I'm satisfied to be conserv-
Ative,—fly straight—do gentle turns—and live.

Ad Astra.

An Explanation

A touring party were having breakfast in Buffalo. When the eggs were served, one exclaimed: "What large eggs!" Said another: "Yes, these are Buffalo eggs."

She—"I see a woman fell the other day and bit off part of her tongue.

He—"Was she married?"

She—"Yes!"

He—"Huh! Some men have all the luck!"—Judge.

Why Not?

"Struggle, but don't get rough when you are kissed," is the advice ladled out to co-eds at Northwestern University in the December number of the Purple Parrot, just issued under the student editorship.

Here are the rules, as laid down at the great Methodist university:

"When a man kisses you, struggle fiercely at first and then appear gradually to be overcome by his superior strength.

"Close your eyes and hold yourself rigid, relaxing a bit if the kiss endures.

"Take your breath in little gasps.

"Let a variety of expressions flood your face—anger, sorrow, despair, joy—it is important that all these be registered.

"Struggle occasionally as if to free yourself.

"Scratch and bite, if opportunity presents itself, but don't dig too deeply.

"As he is about to release you, faint, if possible.

"If you will observe these instructions carefully, he will, most probably, kiss you again."

Sop. Camels

I love little scout-planes:
Their shapes are so pert.
And if I don't crash them
They'll do me no hurt.

—*Ad Astra.*

Biology Pro: Come now, can you tell me something about the joints?

Tres Fresh: Sorry, sir; but I'm quite a stranger in town.

—*Brown Jug.*

The Saturday Line-Up

Teacher: Oscar, what is the Ancient Order of the Bath?

Oscar (*puzzled*): I dunno; Johnny comes first, then Willie, then the baby, and then me.

A Tragedy of the Ultimate Straw

As I was out a-walking
Upon a summer's day
I spied a crumpled aeroplane
Reclining on some hay.

The fuselage was broken,
The wings were somewhat bent;
The engine in the ground had made
A quite alarming dent.

The pilot was a stoic:
He sat upon a stone,
And did not deign to cuss his luck
Or to emit a groan.

Until I mildly questioned him—
The twentieth that day—
"Oh, would you tell me, pray, kind sir,
"Do you always land that way?"

—*Ad Astra.*

Y. W. C. A. Wanted

Prof.: Give some examples of new words being introduced into the English language.

Co-Ed: Vamp, toddle, necking, shim—

Prof.: Young lady, in your case I'd advise a good Christian counsellor rather than English instruction.—*Punch Bowl.*

Lines to Betty's Line

It wasn't Betty's deep blue eyes that got me;
It wasn't Betty's hair of Titian hue;
It wasn't even Betty's wicked dancing—
It was the heavy line that Betty threw.

Twentieth-Century Girl

She: Who was that handsome fellow that sang so beautifully about love?

He (*neither handsome nor musical*): Oh, that bimbo! He chews tobacco, drinks flavoring extract, and has a wife out in Utah.

She: How romantic! When can I meet him?

—*Punch Bowl.*

These jokes may be old,
And should be on the shelf;
But if you don't like them,
Send in some yourself.

Just Try to Be the Fellow That Your Mother Thinks You Are

While walking down a crowded street the other day,
I heard a little urchin to a comrade turn and say:
"Say, Chimmie, lemme tell youse, I'd be happy as a clam
If I only was de feller dat me mudder t'inks I am;
She t'inks I am a wonder, and she knows her little lad
Could never mix with nuttin' dat was ugly, mean or bad.
Oh, lots of times I sit and t'ink how nice 'twould be, gee whizz,
If a feller was de feller that his mudder t'inks he is!"

My friend, be yours a life of toil or undiluted joy,
You can still learn a lesson from this small, unlettered boy:
Don't aim to be an earthly saint with eyes fixed on a star;
Just try to be the fellow that your mother thinks you are.

Author Unknown.

Questions in Seamanship

I am a knot and not a knot. You will find me forward on the starboard side, inside on the outside and alongside the ship's side.

Is the "shivering of timbers" confined exclusively to cold latitudes?

No, they shiver when a ship gets coaled.

To what school are cables sent to get taut?

Is a ship "in irons" when she is placed in dock?

Answer these and we will slip you some more.—Idaho Yarn.

LAIRD
WICHITA KANSAS
AIRPLANES

The Laird Swallow
"America's First Commercial Airplane"

THE Swallow's carrying capacity—three passengers, baggage and full fuel load—is one of the reasons that it is fast becoming America's most popular commercial ship. Let us send you our booklet.

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AA

(*Concluded from page* 474)

but 80 pounds would not cause any excessive bending movement on this tube. Also, the thrust of the propeller which is approximately 700 pounds, has a theoretical factor of safety of 8. The tubes were cast by the Aluminum Manufacturers, Inc., of Cleveland, Ohio, and were produced of their No. 195 metal, heat treated, having an ultimate strength of 40,000 pounds per square inch, or approximately twice that of plain cast aluminum. The elastic limit of this metal is 30,000.

The propellers were attached and all necessary clutch adjustments were made before the motors were started on the stand run. We found that at half power, with both motors, the tubes were absolutely steady, and there was an entire absence of gear noise, and at half power the oil temperature only rose 5 degrees above room temperature. It had been our thought to apply the power gradually, but we opened both motors wide, and both tachometers indicated 1,550 RPM, giving propeller speed of 775 revolutions per minute. This being a static test, the propellers would go up to their design speed of 800 revolutions while in flight. The motors were left open for three hours, at which time the center gear box showed a temperature of 78 degrees Fahr. or 13 degrees above room temperature, which, of course, for a transmission of this type, is quite remarkable. At this speed and during its entire operation, there was not the slightest sign of vibration of any nature, and an entire absence of noise, gear hum, or any mechanical troubles that would indicate improper design. An additional run of 10 hours was completed without the necessity of making any adjustments on the transmission.

While the preliminary drawings and general arrangement were laid out by the Aeronautical Design Division of the Goodyear Tire and Rubber Company, the entire detail design and production of the transmission was put in the hands of Mr. John Riise, Chief Engineer of the Tractor Division of the Wellman-Seaver-Morgan Company, to whom we credit the remarkable success of the transmission unit.

The weight of the transmission without propellers was 593 pounds. The blowers and clutches weighed 88 pounds. This is just slightly greater than the weight of outriggers on some of the airships built in the past.

The transmission driven airship permits the motors to be placed within the car, thereby making them very accessible and in the case of non-rigid and semi-rigid airships, permits Sirocco type fans to be attached directly to the motors, thereby permitting the elimination of scoops, which offer considerable resistance and add considerable weight. It permits any mechanical adjustments to the motors, and in the case of the above unit, a complete cylinder head could be removed while in flight. As the heating up in any transmission is a direct indication of power losses, due to the entire absence of this trouble in the Goodyear type transmision, it is conservatively estimated that an efficiency of 98 per cent is obtained. Due to the fact that the propellers are 11 ft. in diameter, and have a pitch of 10 feet 6 inches, and also due to the reduction of head resistance and the absence of protruding members, there should be a considerable gain in the speed of the unit.

In view of the unit arrangement of the transmission a reverse gear was inserted, which permits the propellers to be reversed without difficulty. The tractor type propellers were so arranged as to permit the edge of the tube to be streamlined. The radiators are to be set on bosses located on the tube, thereby placing them directly in the slip stream. The tractor type propellers offer the advantage of safety by keeping all these mechanical parts to the rear of the blade.

The characteristics of the unit are as follows:

Speed	60 m. p. h.
Rate of climb	1000 ft. per min.
Rate of descent	800 ft. per min.
Cruising radius—full throttle	14 hours
Cruising radius—reduced throttle	20 hours
Percentage of useful load	39
Length	170 feet
Diameter	48 feet
Crew	7

While this unit is an experimental airship, it has proven that even with the enclosed car, transmission, reverse feature and two additional passengers, it is a decided improvement in the non-rigid type of airship. Ships of this design could be constructed up to 300,000 cu. ft. capacity without the slightest difficulty. The entire design adapts itself to the insertion of a rigid keel, which would permit ships up to at least 1,000,000 cu. ft. to be built, with a tremendous saving in the structural weights, and with an assurance of a very high percentage of useful lift.

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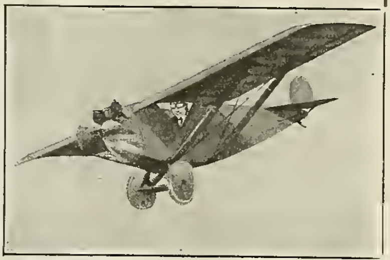

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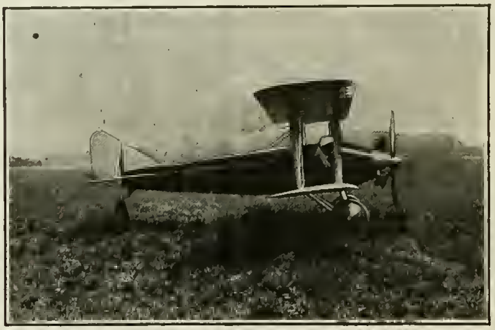

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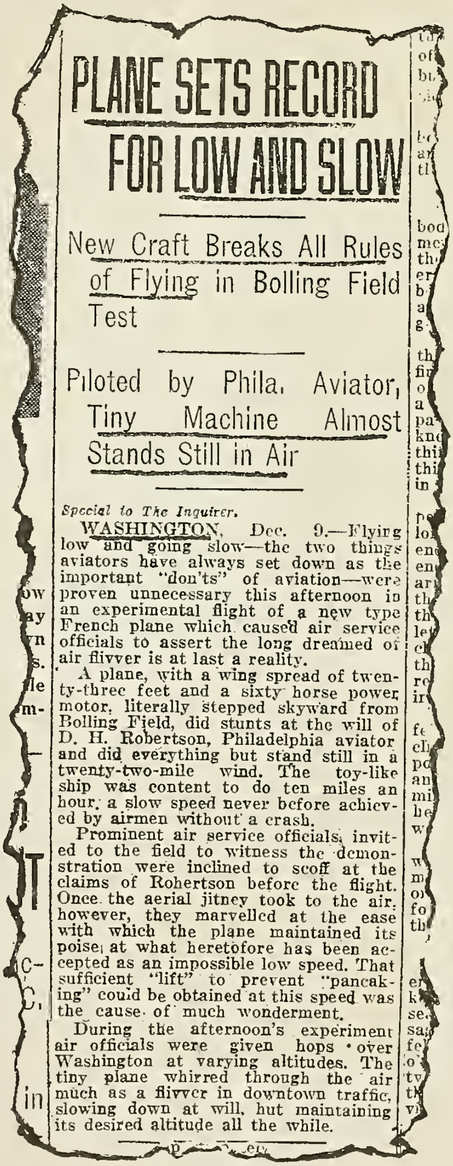

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A plane, with a wing spread of twenty-three feet and a sixty horse power motor, literally stepped skyward from Bolling Field, did stunts at the will of D. H. Robertson, Philadelphia aviator and did everything but stand still in a twenty-two-mile wind. The toy-like ship was content to do ten miles an hour, a slow speed never before achieved by airmen without a crash.

Prominent air service officials, invited to the field to witness the demonstration were inclined to scoff at the claims of Robertson before the flight. Once the aerial jitney took to the air, however, they marvelled at the ease with which the plane maintained its poise, at what heretofore has been accepted as an impossible low speed. That sufficient "lift" to prevent "pancaking" could be obtained at this speed was the cause of much wonderment.

During the afternoon's experiment air officials were given hops over Washington at varying altitudes. The tiny plane whirred through the air much as a flivver in downtown traffic, slowing down at will, hut maintaining its desired altitude all the while.

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Principles of Airplane Design

By George Marsball Denkinger, Research Aeronautical Engineer, Air Service, U. S. A., and Clarence Dean Hanscom, formerly Research Aeronautical Engineer, Air Service, U. S. A. (In preparation. Ready Spring, 1921.) Vol. I. Theoretical and Experimental Aerodynamics. Contents.—Aerodynamics. Wind Tunnels. Wings. Resistance. Vol. II. Applied Aerodynamics. Contents.—Estimation of Performance. Stress Analysis. Weight Estimation. Air Screws. Motors. Materials of Construction. [Wiley.]

Aeronautics—A Class Text

By Edwin Bidwell Wilson, Ph.D., Professor of Mathematical Physics in the Massachusetts Institute of Technology. 265 pages. 6 by 9. 31 figures. Cloth. Postpaid $4.25.

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The Dynamics of the Airplane

By K. P. Williams, Ph.D., Associate Professor of Mathematics, Indiana University. (No. 21 of Mathematical Monographs, Edited by Mansfield Merriman and Robert S. Woodward.) 138 pages. 6 by 9. 50 figures. Cloth. Postpaid $2.75.

An introduction to the dynamical problems connected with the motion of an aeroplane, for the student of mathematics or physics. While not written for the person interested mainly with design and construction, most of the questions treated have some interest for anyone who is familiar with the entire field of aeronautics. The development of the French writers is followed more closely than that of the English and American, the author believing that it is worth while to make a treatment of this general sort accessible to American students of mathematics. Contents.—The Plane and Cambered Surface. Straight Horizontal Flight. Descent and Ascent. Circular Flight: 1. Horizontal Turns. 2. Circular Descent. The Propeller. Performance: 1. Ceiling. 2. Radius of Action. Stability and Controllability: Longitudinal Stability. Stability in Rolling. Lateral Stability. [Wiley.]

Learning to Fly in the U. S. Army

By E. N. Fales. 180 pages. 5 x 7. Illustrated. Postpaid $1.75.

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Aircraft Mechanics Handbook

By Fred H. Colvin, Editor of American Machinist. 402 pages. 5 by 7. 193 illustrations. Postpaid $4.25. New Edition.

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Airplane Design and Construction

By Ottorino Pomilio. 403 pages. 6 by 9. Illustrated. Postpaid $5.25.

This was the first book to be published in this country which presents in detail the application of aerodynamic research to practical aeroplane design and construction. Although the feat of flying in a heavier than air machine was first accomplished in America, the major part of experimental work in aerodynamics has been conducted in Europe. The Pomilios of Italy have had an important part in this experimental work. The data presented in this book should enable designers and manufacturers to save both time and expense. The arrangement, presentation of subject matter, and explanation of the derivation of working formulae together with the assumptions upon which they are based and consequently their limitations, are such that the book should be indispensable to the practical designer and to the student. [McGraw.]

Radio Engineering Principles

By Henri Lauer, formerly Lieutenant, Signal Corps, U. S. A., Assistant in the Preparation of Training Literature on Radio Theory and Equipment, and Harry L. Brown, formerly Captain, Signal Corps, U. S. A., in charge of the Preparation of the Technical Training Literature used in the Signal Service. 304 pages. 6 by 9. 250 illustrations. Postpaid $3.75.

This is the first book to bring the science of radio up to date—to include the wonderful developments made during the war. In no other book published in this country is there such complete information on vacuum tubes. About one-half of Lauer and Brown's "Radio Engineering Principles" is devoted to the discussion of the three-electrode vacuum tube, taking up its use as detector, amplifier, oscillator and modulator. The book covers thoroughly the operation and characteristics of two- and three-electrode vacuum tubes, the practical applications of the tubes, the generation and control of electron flow, and the conditions which must obtain to cause a tube to operate in any of its functions. Aeroplane and submarine radio theory is discussed in detail. Other special applications of the vacuum tube are also treated. Lauer and Brown's "Radio Engineering Principles" is the authoritative modern textbook on the subject. [McGraw.]

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The Aeroplane Speaks

By H. Barber, A. F. Ae. S. (Captain, Royal Flying Corps). Postpaid $3.25.

Captain Barber, whose experience in designing, building and flying aeroplanes extends over a period of eight years, has written this book to be of assistance to the pilot and his aids. Lucid and well illustrated chapters on flight, stability and control, rigging, propellers and maintenance are followed by a glossary of aeronautical terms and thirty-five plates illustrating the various types of aeroplanes and their development from the first practical flying machine. An introduction presents, in the form of conversations between the various parts of the aeroplane, a simple explanation of the principles of flight, written, says the author, "to help the ordinary man to understand the aeroplane and the joys and troubles of its pilot." [McBride.]

Aeroplane Design

By F. S. Barnwell. With a Simple Explanation of Inherent Stability—By W. H. Sayers. With diagrams. Postpaid $1.10.

Mr. Barnwell, who is well known as a highly successful designer, holds a commission in the Royal Flying Corps. The section of this book written by him formed a treatise read before the Engineering Society of Glasgow University. Mr. W. H. Sayers in the second part of the volume elucidates a problem that has been the occasion of much discussion among mathematicians—that of inherent stability. Both sections are fully illustrated by diagrams. This book has been adopted by the U. S. Government as a text book for the instruction of aviators. [McBride.]

Aerobatics

By Horatio Barber, A. F. Ae. S. With 29 half-tone plates showing the principal evolutions. Postpaid $3.50.

This book by Captain Barber, whose earlier work, "The Aeroplane Speaks", is recognized as the standard textbook on ground work and the theory of flight, is an explanation in simple form, and for the benefit of the student, of the general rules governing elementary and advanced flying. Part I, which is headed "Elementary Flying", is an explanation of the essential elements of flight instruction from the moment the student enters the machine until he becomes a finished pilot. The mechanical control of the machine, straight flying, turns of all kinds, stalling, diving, gliding, slide-slips, and various ways of landing, flying through clouds, "taxying" and the first solo flight are described and analyzed fully and in non-technical language, each subject being taken up in progressive order. Part II explains the more advanced evolutions such as looping, spinning, the half roll, the complete roll, the Immelman turn, the falling leaf, the cart wheel, etc. The book contains a progressive syllabus of instruction, a glossary of technical terms and numerous advisory hints. [McBride.]

Flying Guide and Log Book

By Bruce Eytinge. With a Foreword by H. M. Hickam, Major, Air Service. 1921 edition, enlarged and revised to date. 150 pages. 4¾ by 7¼. 38 illustrations, including many photographs of landing fields, and a 24-page Pilot's Log Book for Machine, Motor and Flying. Cloth. Postpaid $2.75.

This book contains valuable information for the aviator, and also, for all those who are interested in, and helping to develop, commercial aviation. Contents.—Calendar. Identification. Frontispiece. Foreword. Past and Present (Poem). Introduction. Don'ts. Helpful Hints. Landing Field Report (Questionnaire). Airdromes—Landing Fields. War Department Orders: Specifications for Municipal Landing Fields. General Flying Rules to Be Observed At All U. S. Flying Fields. Cross-Country Flight Regulations. Rules of the Air. Flying Certificates for Pilots. Trouble Shooting in Airplane Engines. America's Aviation Facilities—Landing Fields (Alphabetically Listed Under Each State). Trans-Continental Aerial Mail Route. Air Routes (Round the Rim Flight). Pilot's Log Book for Machine, Motor and Flying. [Wiley.]

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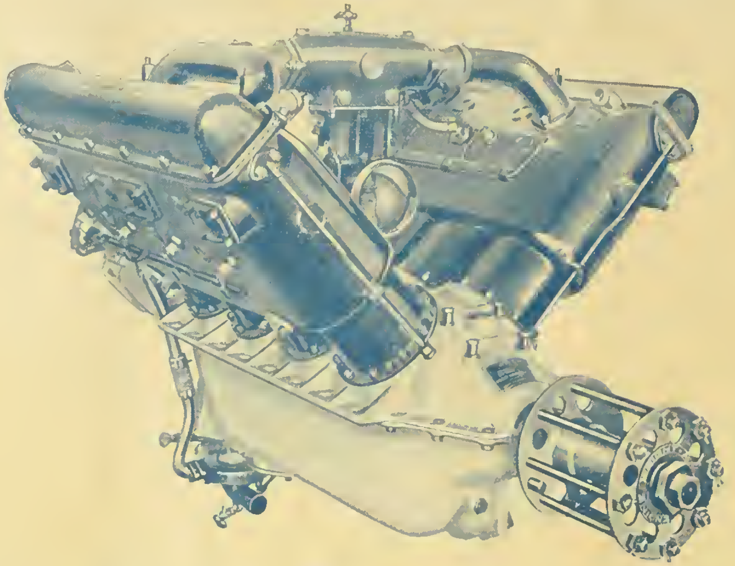

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Carey-Craft
THE CAREY PRINTING CO. INC
NEW YORK

AERIAL AGE
WEEKLY

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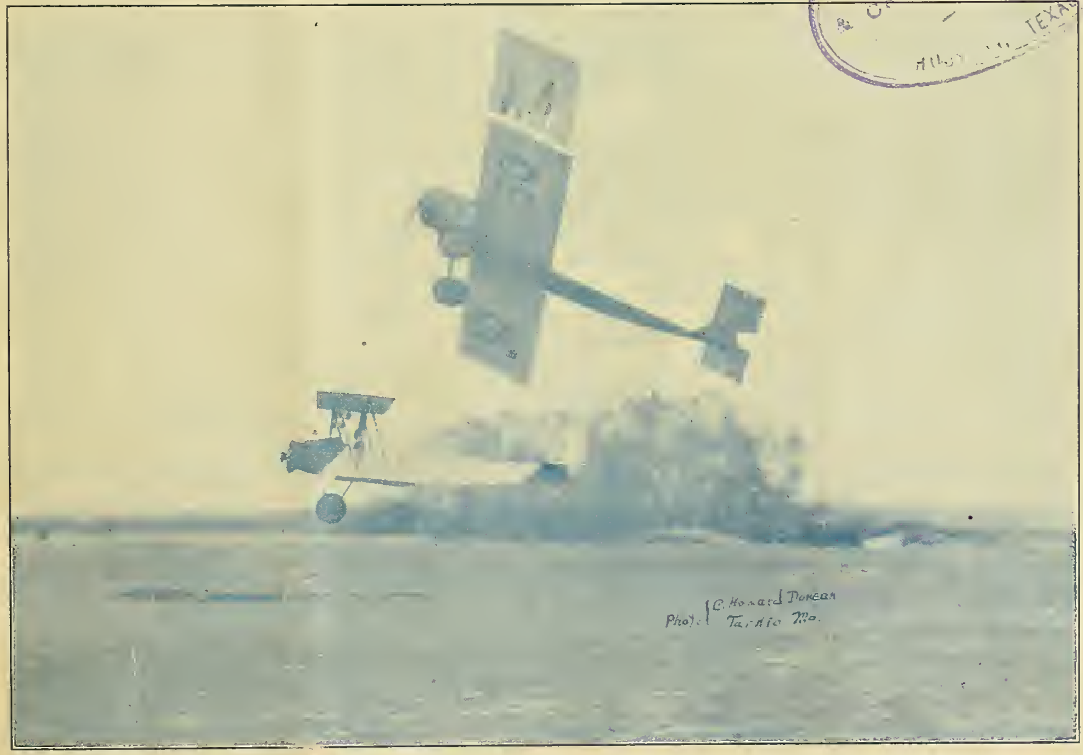

The Sport Farman which has been arousing great interest in various sections of the United States

Text of the Conference Discussion on Aircraft

Air Lines and Some of Their Problems

Danger for the Air Mail

PU LISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
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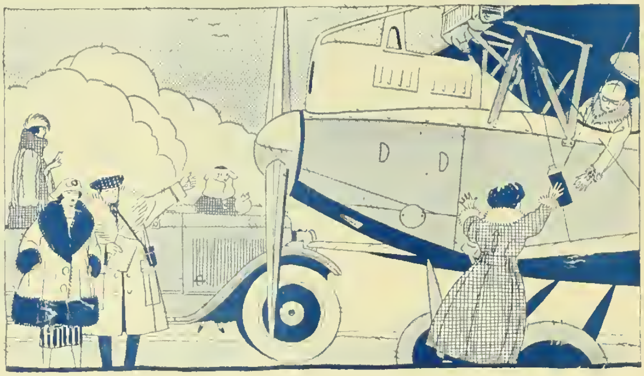

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January 30, 1922 AERIAL AGE WEEKLY **VOL. XIV, No. 21**

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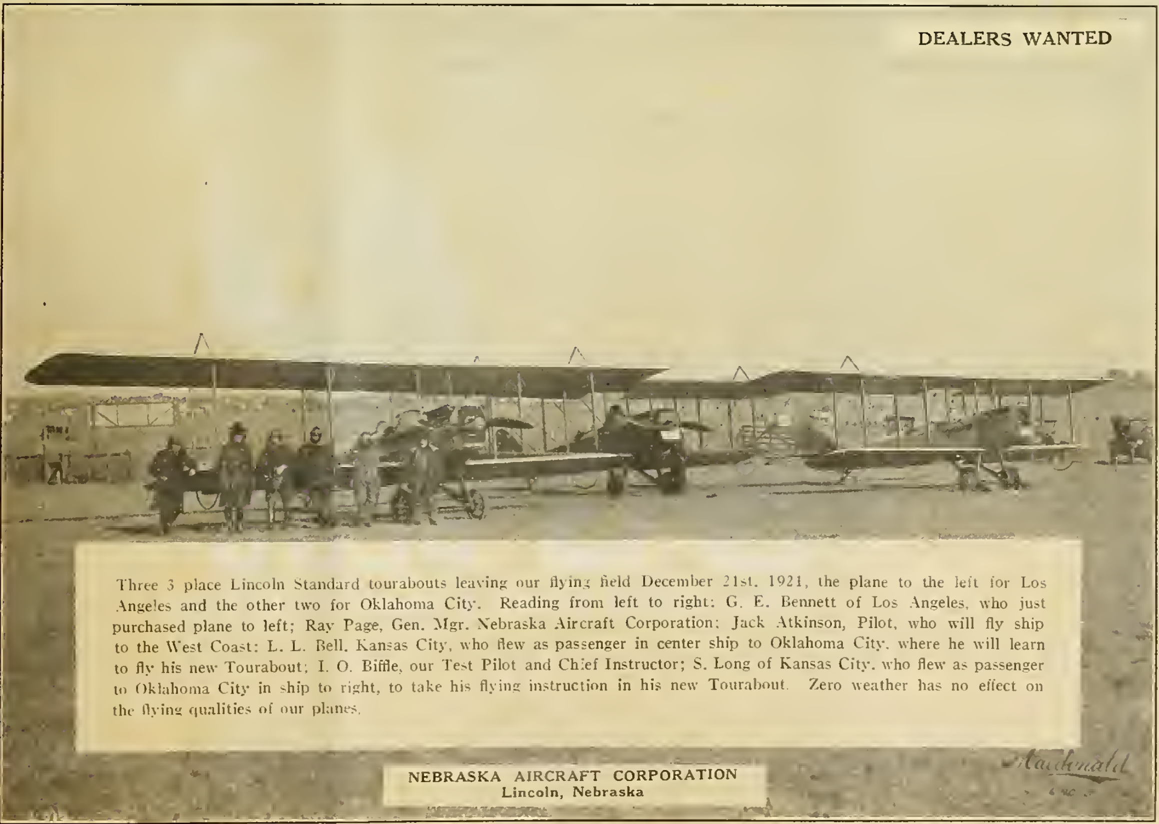

DEALERS WANTED

Three 3 place Lincoln Standard tourabouts leaving our flying field December 21st, 1921, the plane to the left for Los Angeles and the other two for Oklahoma City. Reading from left to right: G. E. Bennett of Los Angeles, who just purchased plane to left; Ray Page, Gen. Mgr. Nebraska Aircraft Corporation; Jack Atkinson, Pilot, who will fly ship to the West Coast; L. L. Bell, Kansas City, who flew as passenger in center ship to Oklahoma City, where he will learn to fly his new Tourabout; I. O. Biffle, our Test Pilot and Chief Instructor; S. Long of Kansas City, who flew as passenger to Oklahoma City in ship to right, to take his flying instruction in his new Tourabout. Zero weather has no effect on the flying qualities of our planes.

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1920 C-6 Motor, dual dep control and balanced ailerons	5600.00	F.O.B. Garden City, L. I.
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With C-6 or K-6 Motor	3600.00	F.O.B. Garden City, L. I.
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C-6 or K-6 (150 H.P.)	3000.00	F.O.B. Buffalo, New York

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Without motor, rebuilt for OX5	1100.00	F.O.B. Houston, Texas
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OX5 As received from Government	500.00	F.O.B. Various concentration fields

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Flying

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VOL. XIV NEW YORK, JANUARY 30, 1922 No. 21

Danger for the Air Mail

IF the Senate is without honor at present, the committee on appropriations for the House is without imagination. It has reported back the postoffice bill minus any provision for the air mail. A service considered by the director of the budget to be worth $2,200,000 is rated by a group of congressmen as a liability.

This action would not be as perplexing as it is had it not been attempted before, year after year. Since the first successful public flying was done in the United States in 1908, Congress has, apparently, considered that any request for money to be used in advancing aviation was an attempt to "put something over" on it. Contrasting the ability of Congress to promote flying with the remarkably little it has accomplished in the way of assistance, one is justified in calling it the greatest obstacle to aeronautical progress we have ever had in America.

The air mail is a pretty good case in point. This service has been in operation almost four years. Acknowledgedly it is the most successful aeroplane service, civilian or military, in the world. It has not cost us during its entire life half the price of one of the battleships Congress voted to build and may soon vote to destroy. It has perfected aeronautical equipment and developed experience worth a fleet of enemy battleships should we ever again have these to encounter. At present it maintains a coast-to-coast service for us. This service has been 89 per cent. perfect during the last year, and has carried almost 100,000,000 letters. Yet we are now called on to explain again to men who should now know the air by three years' experience why the service is valuable to the nation and why its abolition would be a financial loss to us instead of an economy.

It is incredible that the attitude of the appropriations committee of the House is the attitude of Congress. There are sane Congressmen who will surely not tolerate this deliberate suppression of mechanical progress and national interest. The air mail must be continued. Let us hold out our check on a gunboat or a light cruiser instead.

Aeroplane Supervision

FATALITIES among army and civil aviators have now and again run so high as to cause some to wonder whether the men who go into the air with linen wings and motors are always as cautious as they should be. But even under the best conditions there would be mishaps and one must look upon these losses, tragic as they are, as largely inevitable, the price of aeronautical progress. The aviator knows the chances of death and voluntarily takes them.

Those who prefer to stay in the ground have a right to expect immunity from the hazards of aircraft. Men and women who fly for military or commercial purposes, or merely for the fun of it, as some do, must learn that the venturesome or debonair attitude they often hold toward their own safety cannot be carried beyond their personal concern. The death of a woman and the severe injury of a man from the whirling propeller of a grounded and pilotless plane at Red Bank, N. J., shows anew the danger in which onlookers sometimes are placed.

According to the Aeronautical Chamber of Commerce, there are 1,200 aeroplanes operated by civilians in the United States. There are 125 commercial aeroplane operating companies; 275,000 passengers were carried in the last year. Some, like the machine that caused the New Jersey accident, are owned and driven by individuals for sport. Army and navy aviators work under strict regulations which forbid low flying over towns or crowds. The increase in privately operated machines gives rise to the question as to whether some stricter regulation in the interest of the public has not become necessary.

Many have grown weary of excessive numbers of laws and police rules. But, unless there is more general regard for public safety on the part of aviators, we probably shall have more and more rigid official supervision of flights.

(*Editorial in N. Y. Sun*)

THE NEWS OF THE WEEK

The Zeppelin for America

Since our last report on the subject more details have become known of the Zeppelin which the Council of Ambassadors voted to permit Germany to build for the United States Navy. This big airship probably will be built within a year and will then fly to America. It will make the voyage at the risk of the German Government, this being one of the conditions required by the United States Navy Department. Since it will be a dirigible of 70,000 cubic meters capacity and Germany's final Zeppelin, the Government has decided to accept the risk because of the opportunity it provides for proving Germany's superiority in sonstructing lighter than air machines.

The final details of the contract are still unsettled. But unofficial negotiations have already settled the fact that the Zeppelin will be built for America and will fly to its destination. Zeppelin experts assured the Foreign Office that they were not afraid of the test. The success of a Zeppelin which during the war flew to East Africa and return, or a distance equal to that from Germany to San Francisco, makes a voyage to America a fairly simple adventure by comparison, according to the German view.

Before the order is finally placed Germany must be informed of the sum at which the Allies estimate the value of the seven military drigibles which were destroyed after the revolution to prevent their surrender. America's share in this also must be estimated and if this is not as large as the cost of building the 70,000 cubic meter airship America will have to pay the balance.

There is another detail which may be of great importance in determining whether America's Zeppelin will be equipped with all the latest improvements. That is whether the Allies will require Germany to give them the plans of America's airship. In the resolution permitting Germany to build the Zeppelin the Allies reserved this privilege for themselves, and unless the United States insists in her own interests Germany may build an old type airship for the sake of guarding her secrets.

Under the Versailles treaty the hangar in which the Zeppelin is erected, together with the special machinery uesd in its construction, must be destroyed and the workmen dispersed when the American contract has been filled.

W. B. A. C. Progressing

The organization of the World's Board of Aeronautical Commissioners is making rapid progress.

The class of people composing the organization as Commissioners and Chairmen are the leading business and professional men of the world, capable of putting forward the use of aircraft until its full benefits are enjoyed by all.

To date, Jan. 16, 1922, there are: 91 Countries and Colonies of the World represented by 108 Commissioners. 1518 nominated for membership in the United States. 2405 Counties out of 3048 represented by acceptances of State Nominees. 6033 Cities and Towns represented by acceptances of County Nominees. The officers say that when the organization is completed it is estimated there will be 100 Countries and Colonies of the World represented by 125 Commissioners.

Spokane News

Spokane, Wash.—Ex-Lieutenant Floyd Kelso of Lewiston, Idaho, 100 miles southeast of Spokane, was the principal in an unusual experience near Spokane recently. He had come to Spokane to take delivery of a 80 h. p. Curtiss machine, and started in the homeward flight. Ten miles out of the city the plane entered a "war among winds." Opposing currents appeared to concentrate from all points of the compass, forming an aerial whirlpool. Kelso declared it was the most treacherous gale he had encountered in five years flying. The machine was tossed about like a leaf and was entirely out of control. Finally the pilot managed to get out of the maelstrom into calmer air and made a landing in a farmer's field.

Six students are enrolled in a flying class under Lieutenant Kelso at Lewiston and as many more will begin the course next month. With one or two exceptions the students are wheat growers living near Lewiston, who will use their machines, when purchased, in private flights only.

Eddie Stinson and Lloyd Bertaud, pilots, and John Larsen, owner, of the J-L-6, that established the world's endurance record.

CALENDAR OF COMING EVENTS

under sanction of

AERO CLUB OF AMERICA

April 30th (1 or 2 days)
Spring Show and Opening Meet
Place: Curtiss Field, Mineola, L. I., N. Y.
Conducted by: Curtiss Airplane & Motor Corporation, Garden City, L. I.

September 4th (about) 1-day meet for
Detroit Aerial Water Derby
Curtiss Marine Trophy
Class Race Prizes
Invitation Races
Speed Trophy
Place: Detroit River and Lake St. Clair.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

September 15th (about) 3-day meet
Pulitzer Trophy
Detroit Aerial Derby
for Aviation Country Club of Detroit Trophy and Liberty Engine Builders' Trophy and Class Race Prizes
Invitation Races
Detroit News Aerial Mail Trophy
for Multimotored Aeroplanes Speed Trials
Place: Mt. Clemons Field, Detroit, Mich.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

August 15th (about)
In Preparation by the Aero Club of America
American Elimination Trials, if Necessary for La Coupe Deutsch de la Meurthe (Race to be held in France about October 1st. Place: Mitchel Field, Mineola, L. I., N. Y.

September 30th
First Annual Interservice Championship Meet
Open to the personnel of
The U. S. Army, Navy and Marine Corps Air Service
Championships in Single Seater Fighting Bombing Reconnaissance Races Photography Races Formation Flying, Etc.
Location: Mitchel Field, L. I., N. Y.

August 1st (about)
Foreign Events
Coupe Jacques Schneider
Contest for Flying Boats and Seaplanes
Place: Italy (probably Venice).
Conducted by: Aero Club d'Itali, 24 Via Tor de'Specchi, Rome.
American entries received by the Aero Club of America.

October 1st (about)
Coupe Henry Deutsche De La Meurthe Race for Aeroplanes
Place: France.
Conducted by: Aero Club of France, 35 Rue François-1, Paris.
American entries received by the Aero Club of America.

The AIRCRAFT TRADE REVIEW

A. S. M. E. News

The first issue of the A. S. M. E. News appeared on December 22 and will be published twice a month from now on by the American Society of Mechanical Engineers. The publication carries information regarding activities of the society, its local sections and professional divisions.

The Slotted Wing

We are in receipt of the following letter from Walter E. Gilbert, of Vancouver:

Your leading article, by your Mr. B. C. Boulton, entitled "The Fallacy of the Slotted Wing," which appeared in AERIAL AGE, issue of November 5, has just come to my notice.

As a commercial pilot, one who makes no attempt to dispute the accuracy of the purely technical aspect of your arguments, I beg to offer some few words of criticism of your statements, from a practical view point only.

To me, the condemnation of Mr. Handley-Page's "slotted wing," as the exemplification of a "fallacious principle" is not only unjustified at the present time, but also to some degree, inaccurate.

I have had personal experience with the type of "Handley-Page" to which this new wing has been applied, and have observed the performance thereof since the alteration, though I have not in person flown it in this condition. Hence my interested opinion on its value.

One of your major objections appears to be that the Handley-Page wing is not applicable to machines for essentially war-time use, and one of the concessions you make in its favor is that it makes possible "decreased landing speed with wing loadings kept close to their present values," adding, however, that "landing speeds obtained with present design are reasonably satisfactory."

In dealing with these points, it must first be realized that the Handley-Page multiple-engined commercial machine is intended as a commercial carrier and not as a war-time weapon. Its possibilities as a "long-distance bomber" are now subordinated to its peace-time uses, as exemplified by its record of service in the "London-Paris Air Line," in the period 1919-21.

Further, while securing speed without unnecessary sacrifice of power applied is highly desirable in the heavy commercial machine, surely the issue of paramount importance is that of providing for the *safety* of passengers, freight, and the very valuable machine itself. And in securing this, one of the most desirable assets is the ability to be landed in the small areas available in cross-country flying when sudden need arises. An examination of the reports issued by the Air Ministry in London demonstrates quite clearly how greatly "forced landings," from one cause or another, contribute to the annual total of casualties and financial loss in commercial aviation.

In "forced landings," granted that the pilot possesses the requisite amount of skill, a low "landing-speed" is *all*-important. And while those now existing may be termed "reasonably satisfactory," the comparative hazard in "forced-landings" is all too apparent, and goes to show that a further reduction in the rate of "landing-speeds" is essential, if *really* "safe" air-travel is to be secured.

One way of securing this reduction is by the substitution of the "slotted wing." With it, in its original form, the desired result was partially secured, and more recent tests have shown a further improvement, using the same machine as in the original trials.

In considering these few suggestions, does it not appear that, Mr. Kerber's theory notwithstanding, the Handley-Page Wing "fallacy" has actually contributed to the safety of commercial aviation, and that after all Mr. Page's designer—a pioneer in aeroplane design—should, results obtained rather than opposing theories being considered, be given a little more consideration by your "technician" before being condemned as the parent of a "false train of thought?"

UNITED STATES POST OFFICE DEPARTMENT—AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, November 1921

DIVISION	Gasoline	Grease and Oil	Repairs and Accessories	Miscellaneous	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone and Water	Office Force and Watchmen	Warehouse	Pilots	Mechanics and Helpers	Testing & Experimental Work at College Park	Radio	Departmental Overhead Charge	TOTAL	SERVICE AND UNIT COST				
															Gallons of Gasoline	Total Time Run Hr., Min.	Total Miles Run	Cost per Hour	Cost per Mile
EASTERN New York-Chicago.....	$4,320.15	$929.97	$2,472.68	$3,741.12	$1,519.12	$1,153.62	$3,254.04	$1,673.18	$4,352.29	$4,718.79	$190.31	$2,376.13	$841.03	$31,542.43	12,524	441 23	39,981	$71.44	$0.79
CENTRAL Chicago-Rock Springs	5,000.80	1,568.95	a10,985.70	2,862.74	1,207.63	799.87	3,696.49	2,423.24	6,099.45	7,595.09	275.62	3,441.30	1,218.03	47,174.91	17,994	682 21	61,287	69.14	.77
WESTERN Rock Springs San Francisco	3,336.55	561.27	b12,922.13	1,876.61	1,381.21	577.47	3,362.32	1,673.19	4,452.11	5,150.16	190.31	2,376.13	841.03	38,700.49	11,240	478 47	41,877	80.82	.92
Totals and Averages....	$12,657.50	$3,060.19	$26,380.51	$8,480.47	$4,107.96	$2,530.96	$10,312.85	$5,769.61	$14,903.85	$17,464.04	$656.24	$8,193.56	$2,900.09	$117,417.83	41,758	1,602 31	143,145	$73.27	$0.82

a Includes new motor in plane No. 166.
b Includes new motors in planes Nos. 158 anf 167.

Total Operating Cost........................	$117,417.83
Permanent Improvements........................	7,134.65
Grand Total........................	$124,552.48

COST PER MILE			
Division	Overhead	Flying	Maintenance
Eastern........................	$0.23	$0.24	$0.32
Central........................	.17	.21	.39
Western........................	.21	.20	.51
Entire Service........................	$0.20	$0.21	$0.41

Overhead consists of: Departmental Overhead; Office Force and Watchmen; Motorcycles and Trucks; Rent, Light, Fuel, Power, Telephone and Water; Radio; Testing and Experimental Work.

Maintenance consists of: Miscellaneous; Mechanics and Helpers; Repairs and Accessories; Warehouse.

Flying consists of: Gas; Grease and Oil; Pilots.

E. H. SHAUGHNESSY, Second Assistant Postmaster General.

TEXT OF THE CONFERENCE DISCUSSION ON AIRCRAFT

FOLLOWING is the text of the official communiqué issued by the Conference on Limitation of Armament dealing with the discussion of aircraft in the session of the Committee on Limitation of Armament:

The eighteenth meeting of the Committee on the Limitation of Armament was held Jan. 9, 1922, in the Pan-American Building. The committee had under discussion the report of the Subcommittee on Aircraft.

Mr. Schanzer said:

The subcommittee of experts has come to the conclusion that there is no practical method for limiting military and naval aviation. The Italian member of the subcommittee was alone of the opinion that such a limitation could be obtained by limiting the number of pilots of the permanent military organizations; and since the other powers are willing to accept the conclusions of the subcommittee and a proposal aiming at the limitation of air armaments would have no chance of being accepted today, we will limit ourselves to expressing the desire that the future conference which will be called to study and define the laws of aerial warfare should take up again also the question of the limitation of aerial armament.

We have always insisted on the limitation of armaments in all fieldsand would deem it regrettable that competition, which we have partially succeeded in excluding from naval armaments should be transferred to the dominion of miltary and naval aviation; this would be a serious drawback to the work of the economic reconstruction of our countries, which it is the duty of each of us to have in view.

Mr. Underwood:

Mr. Underwood said that he had not expressed his views very much to the conference. He was in hearty accord with what it had done. He himself believed in real disarmament, looking to the permanent peace of the world, and he would be very glad to vote for the cutting out of any instrument of war if it really affected the situation; but heavier-than-air craft and lighter-than-air craft both were used for land armament as well as sea armament. The man who was trained in one machine could fly in the other and, in the main, the machine that might be used with land armies, with slight changes could be used in naval warfare.

He personally would be very glad to see the question of limitation of land armament taken up, but he understood the conditions that confronted them and knew that it was not probable that it would come before this conference, for reasons that it was not necessary to go into. Therefore it did not seem to him practicable to pass resolutions in reference to the limitation of aircraft at this time. For that reason his view was in accord with the view of the technical subcommittee.

Mr. Balfour:

Mr. Balfour said that it was impossible to resist the practical conclusions of the Subcommitte on Aircraft with regard to the limitation of heavier-than-air craft, which he understood was the point for immediate discussion. This was regrettable, because one must regret anything that restricted our power to limit armaments, whether by land or sea or air. But we must accept the facts as they now appear, and leave it to some future time to deal with the subject, when the technical differentiation between war and peace aircraft should have become clearer.

Senator Underwood had put with great force a further special obstacle that stood in the way at the moment. As he had shown, the conference was precluded from dealing with the larger problems of land armaments. Aircraft were land arms as well as naval arms. Accordingly, to deal with the limitation of aircraft at this time would be to deal with only a fraction of the subject of land armament and to leave wholly untouched the larger proportion of the great problems connected with it. There was another general argument pointing in the same direction. Unlike the case of submarines, in the case of aircraft military and civilian uses were not sharply divided. There was practically no commercial civil use for a submarine, but there were many who thought that the development of aerial invention was going to exert an immense influence upon the economic development of mankind and upon the inter-communication of different peoples. In the present stage of their knowledge of air matters it seemed quite impossible to limit aircraft designed for military uses without also limiting aircraft designed for commercial uses; so that every restriction which could be put upon aircraft would have a double reaction.

It might, and perhaps would, diminish the number of aircraft which could be used for military purposes, but it could not carry out that object without also diminishing the number of aircraft to be used for the peaceful purposes of international intercommunication. In those circumstances he must admit with reluctance, but with a clear conviction, that probably the subcommittee was in the right when it said it would be quite hopeless, and not only hopeless but undesirable, to attempt at the present time and in the present stage of our knowledge to limit aircraft. He has, therefore, prepared to give his adhesion to the first part of the first resolution.

Mr. Sarraut:

Mr. Sarraut said that he had just listened to the presentation of a certain number of observations in consequence of which he desired to state that the French delegation gave its full assent to the first resolution proposed by the committee. The reasons adduced appeared to him excellent and the conclusion reached by the impartial investigation of the experts was luminous.

If he might be permitted to express his personal point of view, he would say that he still regarded with the gravest apprehension any act which might be of a nature to paralyze the progress of aviation. He had a profound belief in the beneficial effects to humanity of aviation. If it resulted in terrible engines of war, it might also be an instrument of the first importance in time of peace.

Already, indeed, the plane was used in the adminstration of those distant and desolate lands called great deserts by the experts, and where, more than anywhere else, suffering humanity had need of care and assistance. In the French colonies, very serious efforts had been made to effect the long-distance transportation of essential objects and to bring medical and surgical assistance. Very important results had already been attained along these generous and humane lines.

Under these conditions, it would be very wrong to do anything that might hamper the progress of aviation, and it was with this understanding that the French delegation gave its full and entire adherence to the proposals of the committee.

Baron Kato:

Baron Kato said that the question of aircraft did not demand elaborate discussion at present. He believed, however, that the time would come when it would be necessary to effect a limitation upon the use of aircraft. He agreed with the conclusion of the subcommittee that it was impracticable at present to effect any limitation upon the use of "heavier-than-air" craft. Therefore, he accepted the proposal on behalf of the Japanese delegation.

Secretary Hughes:

The Chairman (Mr. Hughes) said that he thought that they all felt a deep disappointment in being unable to suggest practical limitations on the use of aircraft in war or on the preparation of aircraft for military purposes. They knew full well that in aircraft there was probably the most formidable military weapon of the future. And yet, addressing themselves as practical men to the problem, they found no answer to the arguments which had been set forth succinctly, but most forcibly, by the technical subcommittee.

The reason was, as had been well stated, that they were dealing in substance with facilities that were needed in the progress of civilization. They could not put a ban upon progress. They also knew, even if they prohibited all aircraft for military purposes and allowed the development of the art to meet the requirements of civil life, that in time of war the bases of that development would be immediately available and within a short time provisions would be made amply for any possible military uses.

The question, therefore, reduced itself not to one of limitation of armament but to a limitation of civil progress; and faced with that difficulty, there seemed to be no alternative but to adopt the first resolution so far as it applied, as it did apply, exclusively to heavier-than-air craft. This appeared to be the sense of the committee.

The Chairman then said that the next question was whether it would be deemed practicable to impose a limitation in the case of lighter-than-air craft. He asked to call their attention to what the subcommittee said with regard to this subject. The statement was very short, and it brought before them the point quite clearly, and, with their permission, he would read it. The subcommittee said:

"Many of the remarks already made apply to lighter-than-air craft, but, as in the case of commercial aircraft of this nature, limitation is both possible and practicable. It is unnecessary to recapitulate the argument that the military value of a dirigible is dependent on its size, and the size of dirigibles and the number maintained can be limited by agreement on a few simple rules. Infraction of such rules can be rapidly ascertained without detailed inspection. But such a limitation of lighter-than-air aviation forces would not effect a limitation of this kind of air power of a nation unless a limitation were also imposed on its lighter-than-air commercial activities.

"The line of demarcation between the large commercial airship and the military airship is very slight, and a commercial dirigible would require little, if any, alteration in order to adapt it to military purposes. The objections to the limitation of the number or character of commercial lighter-than-air craft have already been remarked on."

Oppose Limiting Air Science

That allusion was, apparently, to the fact previously emphasized in the report, as follows:

"As regards the desirability of limitations the committee has touched on those factors which must be understood before arriving at a decision. It feels it to be a duty to lay great stress upon the following fact which will have a decided bearing upon any determination of the proper policy to be adopted; any limitation as to the number and character of civil and commercial aircraft, heavier-than-air or lighter-than-air, which is efficacious to hinder their utilty for war purposes, must interfere disastrously with the natural development of aeronautics for legitimate civil and commercial enterprises.

"To limit the science of aeronautics in its present state is to shut the door on progress. It is for the conference to decide whether the limitations which can with difficulty be devised and imposed are to be adopted at such a cost."

It was, therefore, practicable to impose a limitation, by agreement, upon the size of dirigibles. Questions as to limitation of number could be considered separately, but certainly it was practicable to impose a limitation upon size. The question was whether it was desirable to do so, in view of the fact that commercial dirigibles could be converted into military dirigibles and therefore the question was whether the advantage in the limitation of armament, that is, in having an agreed limit of size of dirigibles, was so great that it offset the disadvantage of limiting the size of dirigibles for commercial purposes. The Chairman presented that question for discussion.

No one desired to discuss the matter.

The Chairman then asked if it was the desire of the committee to state, as their conclusion, in view of the arguments presented by the sub-committee, that it was not practicable to impose limitations upon lighter-than-air craft, or if it was their desire to present a resolution containing such a limitation.

Senator Schanzer said that he only desired to ask the Chairman if the first proposal, which made an exception for lighter-than-air craft, were approved, might it not seem that the exception were approved also. He suggested the elimination of the words, "excepting in the single case of lighter-than-air craft."

The Chairman said the suggestion of Mr. Schanzer was that it would accomplish the purpose, if it was not proposed to put a limitation upon the lighter-than-air aircraft, to adopt the conclusion of the subcommittee, leaving out the last clause, so that the sense of this committee would be stated to be as follows:

"The committee is of the opinion that it is not practicable to impose any effective limitations upon the numbers or characteristics of aircraft, either commercial or military."

The Chairman said that it was suggested by Mr. Balfour that the words "at present" should be inserted before "practicable." That seemed to be a very good suggestion; because that was what they were doing—not indicating that in the future it would not become practicable. Then the resolution would read:

"The committee is of the opinion that it is not at present practicable to impose any effective limitations upon the numbers or characteristics of aircraft, either commercial or military."

He then asked for assent to this, and it was unanimously adopted.

The Chairman then said that they came to the next recommendation or conclusion of the subcommittee, as follows:

"The committee is of the opinion that the use of aircraft in war should be covered by the rules of warfare as adapted to aircraft by a further conference which should be held at a later date."

The subcommittee had taken occasion to review the difficulties, at the present conference, in adopting detailed rules of war.

Mr. Schanzer:

"We approve the proposal which aims at the convocation of a conference for the study of the rules of aerial warfare. But we believe, gentlemen, that certain principles of international law exist in relation to the use of aerial weapons, which deserve to be solemnly proclaimed today, by this same conference.

"Since we have accepted, for humane reasons, the prohibition of the use of submarines against merchant vessels, we feel it our duty now, in consistence with principles of justice and coherence, to put forward in our turn a proposal concerning the use of military aeroplanes and airships and of all other warlike means for the bombardment of open towns.

"Everybody recalls the horrors and atrocities perpetrated by the Germans and their allies during the last war, when open towns were bombarded with so large a sacrifice of the lives of non-combatants, women and children. In certain countries many towns suffered by such bombardments, which were a menace not only to the peaceful inhabitants, but also to historic buildings, to monuments, to immortal works of art which certain towns possessed, and which were the patrimony not only of the towns directly smitten, or of the nation to which the towns belonged, but of the whole of humanity."

Admiral de Bon

Admiral de Bon fully endorsed the views of Mr. Schanzer. He recalled that Article 25 of The Hague Convention of 1907 prohibited the bombardment of unfortified cities in any manner whatever. During the late war, unfortified cities were bombarded not only by airplanes, but by land and naval artillery.

Mr. Root:

Mr. Root said that there was some uncertainty or alleged uncertainty in the application of The Hague rule regarding the bombardment of undefended towns to the action of aircraft. Of course, when the rule limited bombardment to defended towns, when it prohibited the bombardment of undefended towns, it had reference to military or naval operations against towns that afforded military or naval obstacles to those operations, and as to those towns the provision was that the commander should notify the defended place so that the civilians might have an opportunity to withdraw. As to the undefended towns, he must not bombard them at all.

Now, those distinctions did not seem to fit bombardments from the sky. No town was defended against such bombardment. If the rule were strictly applied, it did not prohibit the bombardment of Paris, because of the fortifications surrounding Paris. It was a defended town. Most of the cities in Europe had some sort of defense.

He fully sympathized with the view which Senator Schanzer took. If the committee were going to act, he wished Senator Schanzer would apply his very acute intelligence toward making this rule more definitely applicable to the existence of circumstances of aircraft and a town defended as against land attacks but wholly undefended as against air attacks, and resolve the uncertainty that resulted from the fact that the rules were not made for air attacks. He thought the committee would render very useful service if it could do that, far beyond merely repeating a rule and leaving this uncertainty.

When one considered these two rules, that a defended town must not be bombarded without notice sufficient to enable the innocent—the women and the children and noncombatants—to withdraw and that an undefended town must not be bombarded at all; when one considered these two rules, the spirit of them could prevent aircraft from bombarding any town whatever. Bombard a railroad junction, a station crossing? Yes. Bombard a munition factory? Yes. But the centre of an innocent population? No, not under any circumstances at all. For that reason, Mr. Root concluded, the rule was inadequate, and if the committee were going to speak, they ought to make it adequate.

Secretary Hughes:

The Chairman said there seemed to be general acceptance of the spirit and purpose of the proposal made by Senator Schanzer. It was obvious from the discussion that in detail the matter was one which, like other rules relating to war, would require the most careful and probably protracted consideration of a commission of jurists, in order that the new situations which had been developed should be carefully developed and rules framed with precision to meet them.

The Chairman said that the committee was now considering the recommendation of the sub-committee that rules of warfare should be considered by a further conference. He suggested for the consideration of the committee that instead of taking that course, provision should be made for the creation through the action of the powers here represented, of a commission of jurists, which should, at an early date, take into consideration the question of rules of war which seemed to be demanded by new exigencies and revelations or the adaptation of new instruments of warfare to the end that recommendations might be presented to the powers for their acceptance. The Chairman feared that a future conference, for example, dealing with a question of this technical character—technical in the sense that it would require very close study by jurists—would find itself much in the same position that the committee was in: It would have to wait until it was advised by legal experts.

Perhaps the best form that this could be put in, and the most practical action, would be for the powers here to agree to designate members of a commission of jurists, who should make a report and recommendation.

Sir Robert Borden:

Sir Robert Borden said that at the previous meeting he had made a suggestion on this subject. He was, however, quite content that what he had said then should be left for the consideration of the proposed future conference or commission.

Even a commission of jurists would find extreme difficulty in dealing with a question so complicated in nature. It was obvious that the present conference could not deal with it satisfactorily. Senator Root had observed that a railway junction or a munition factory might properly be subjected to bombardment. But inasmuch as modern warfare by its very nature involved all the energies of each nation engaged it would be found that railway junctions, munition factories and other such points of atack were everywhere scattered among the habitations of the innocent population.

Accordingly it would be necessary to consider how far and by what restrictions the bombardment of such points could be prevented and, on the other hand, to consider whether it would be feasible to prohibit absolutely any attacks on such war objectives. The subject was an entirely proper one for some future commission or tribunal, but it should be considered whether or not the establishment of such a commission would be appropriately confined to the five powers here represented.

Secretary Hughes:

The Chairman replied that it was his idea that it should not be so confined, but that representatives of the five nations should initiate the project. He said that he supposed that a resolution for the constitution of such a commission of jurists would have to be considered most carefully in order that it should be framed with precision and that it might well be committed to the Committee on Drafting, with instructions to brng in an appropriate resolution to the end sought.

It might be sufficient now to declare the adherence of the committee in principle to this, that nations here represented should provide for the appointment of a commission of jurists to consider the rules of war which were affected by the events of the late war, and also require investigation in the light of the development of new agencies of warfare; and he would ask if there was any objection to adherence to that principle, leaving the precise resolution to be formulated by the Committee on Drafting.

Mr. Balfour:

Mr. Balfour said that he thought the Chairman was well advised in saying that this matter should probably be considered a little more closely than it was possible to consider it on an occasion like the present or in the present assembly. Therefore he welcomed the view that the matter should go before the Drafting Committee. He had, however, two suggestions to make which he hoped the Drafting Committee would consider. The first that it would be most inadvisable in his opinion, to limit the matter to jurists.

That was a point which concerned not merely the framing of the law or the mode of fitting into the general tissue of our system of international law any new laws or rules that might be devised. For that purpose, no doubt, jurists were essential, and jurists should play a very great part in any inquiry such as that now proposed. But, after all, the people who had seen those instruments at work, who knew what those instruments had involved in the past and what they were likely to involve in the future, should have more to say in regard to the framing of such rules than the most expert authority upon international law. He thought that they should play a not less important part in any inquiry which was made on the subject.

He (Mr. Balfour) did not know whether his second suggestion would meet general approval, but he would very much like to see the area of inquiry reasonably limited. International law, and especially international law dealing with the laws of war, was extraordinarily complicated. He could not deny that it ought to be dealt with and he could not see how anybody could deny it. For himself he could not refuse to accept the proposition that the mere fact of development of methods of warfare carried with it an almost inevitable corollary that the rules of warfare should be revised.

But that subject was so complex and so enormous and was so certain to lead to much difference of opinion within the committee of experts and jurists that he would like to divide such an inquiry into two parts. The part of the general inquiry in which they were most interested, which had most usefully occupied some of the attention of the conference, was really adequately described in the list of the agenda which the Chairman had brought forward on behalf of the Department of State at the beginning of their labors. Among the subdivisions on the subject of limitation of armaments there was the following sub-heading: "Rules for the control of new agencies of warfare."

It seemed to him if the conference would limit, at all events in the first instance, the work of the mixed committee of experts and jurists to rules for the control of new agencies of warfare, they would be more likely to come to a speedy conclusion and much more likely to obtain a conclusion which would be unanimously adopted. He, therefore, suggested for the consideration of all his colleagues round that table whether that humbler but still all-imporant subject would not be sufficiently wide in its scope to occupy the attention of even the most powerful committee which they were able to provide for its investigation.

Secretary Hughes:

The Chairman said there was great force in the suggestions made by Mr. Balfour, and he personally, had not the slightest objection to their adoption. It was not at all the intention that this proposed commission should consist of jurists who would work in disregard of the recommendations of technical experts. He supposed that the jurist representing each country would be advised very fully of all technical matters by both naval and military experts, but when it came to the point of formulating the legal rules which should be adopted, it would require the special training of jurists in order that the information and advice and proposals furnished by military and naval experts could be adequately considered and those which were adopted suitably expressed.

There was not, however, the slightest objection to having the commission itself enlarged, if that would seem to be desirable. He had found, however, that when it came to a question of drafting rules, the fewer there were who were actually engaged in the work the better the prospect of success; and while each one charged with the responsibility should have all the information available and the aid of all the experts who could possibly throw light upon the subject, a very few men competent in drafting, associated together for that purpose, could accomplish much more than a large committee.

He also felt the force of the suggestion of limiting the scope of inquiry. That was very carefully considered when the tentative agenda was suggested, and the proposal made to which Mr. Balfour had referred.

It seemed to the Chairman that the question of the method of constituting the commission and the scope of the inquiry to be entrusted to it could well be committed to the consideration of the Committee on Draft and the committee could await their recommendation. If that was agreeable to the delegates, he would simply ask assent in principle to the constitution of a commission for the purpose of dealing with the subject of rules of warfare in the light of the development of the recent war.

Mr. Balfour said that while he was perfectly ready to have the matter referred to the Drafting Committee, he would like to make reservations limiting the scope of the Drafting Committee's work, and asked the Chairman's advice as to how this result might be attained.

The Chairman assumed that both of the suggestions Mr. Balfour had made should be deemed as referred to the committee and that they would take those into consideration as well as others that might be advanced in the course of their discussion, and that the committee should bring in a recommendation, which could then be discussed in the light of the arguments they advanced for its support.

Mr. Balfour said that would be satisfactory.

After a vote was taken, the Chairman announced that the suggestions as to the reference to the Drafting Committee were unanimously approved.

Thereupon the committee adjourned.

AIR LINES AND SOME OF THEIR PROBLEMS

By R. B. C. NOORDUYN, New York, N. Y.

(Paper presented before the American Society of Mechanical Engineers)

THE air lines in operation in Europe since 1919 have proved a great attraction for Americans who have formed, in fact a surprisingly large percentage of the passengers carried. The favorable impression which they invariably bring home of the new method of travel encourages the belief that once air lines are running in this country and can promise to equal the performance of those with which the traveler has become familiar abroad, public support will be forthcoming to a greater degree than has been generally anticipated.

In the United States last year, the mileage covered by commercial or privately owned aeroplanes was estimated by the Manufacturers' Aircraft Association, from reports received from operators all over the country, to be not less than six million miles, in the course of which some 225,000 passengers were carried. The Frenchman, who is accustomed to using a time-table for the next plane for London or Amsterdam, and buying his ticket at the nearest travel bureau, looks at these figures and thinks that the air lines in this country must be doing a good business. If this large mileage were actually covered in the operation of scheduled services over fixed routes, instead of in unorganized short flights, we could indeed consider air travel to be an established factor in everyday life.

As a precursor of regular services the present volume of flying must not be underrated. Its educative value is very great as the passengers carried on short flights now will be the patrons of the air lines of the future. Further, personnel, pilots, and mechanics are being trained, and ground organization, landing fields and service stations are being developed all over the country, although slowly and on a modest scale.

What, then, are the difficulties which have so far stood in the way of rapid development of regular inter-city air lines in this country?

Briefly, the aeroplane finds itself today in that stage through which many new inventions have passed, and in which the article itself has reached a more advanced state of development than the facilities and accessories necessary for its completely effective use.

The modern commercial aeroplane has all the qualities requisite to passenger vehicles generally, whether land, sea, or air going, with the addition, naturally, of a few of its own. As for comfort, passengers are seated in chairs similar to those in Pullman car, in cabins easily entered through full sized doors a step or two from the ground, protected from wind, cold and engine smells. They view the scenery through large windows. The motions of an aeroplane are far more gentle than those of any other vehicle, while sense of speed and vertigo are entirely absent in straightforward flying and there is no dust or dirt.

Safety and reliability under organized operating conditions are now such as to justify anyone in entrusting life and property to the air; according to the latest time-tables the regular passenger and freight lines in Europe are covering 22,000 miles per day. Table 1, a summary of British Air Ministry weekly reports on the traffic between London and the Continent, shows some interesting figures. On the three routes operated, 3088 flights were started during the first 10 months of 1921, of which 91½ per cent. were carried out in good order, which represents a distance of 700,000 miles flown and at least 6200 starts and landings made without one single passenger being hurt seriously. These figures are the more remarkable when taken into consideration with the very unfavorable weather conditions for which the region of the English Channel is notorious.

The United States Air Mail Service, which is operated over a series of route sections somewhat shorter in average length than the European lines, completed 95 per cent. of the 6690 flights attempted during the first 9 months of 1921, in the course of which 1,332,000 miles were flown with mail. On the Cleveland-Chicago section the twenty-fifth successive week of 100 per cent. performance was recently reported. However, it must be remembered that the Mail Service is supplied with a far greater number of aeroplanes and engines in proportion to the length of its routes than any private company striving to operate at a profit could afford, and also that, when carrying mail only, flights often can be successfully carried out under conditions which would be incompatible with the safety of passengers. The figures given do not, therefore, provide a satisfactory basis on which to judge the relative merits of equipment and personnel between the U. S. Air Mail and the European passenger lines, so far as regularity of performance is concerned.

Finally, in judging the present status of the aeroplane as a means of transportation, the all-important question of operating cost must be considered. The first air lines started operations hopefully, on the assumption that their small first outlay, on the purchase of converted war planes at a fraction of the manufacturing cost, and the supposed imperative demand of modern business for speed above all things, would insure at least a paying business from the beginning. How sadly they were disappointed is clearly shown both by the history of the companies concerned and the rapid, if not yet quite complete, disappearance of these machines from the chief airways of Europe.

Large numbers of 3-seater machines, converted fast day bombers, were in use during the first year or two after the war, which showed a dead financial loss on every trip, even when loaded to full capacity, which was by no means always the case. Large twin-engine bombers, capable of carrying about 10 passengers, solemnly ploughed their way daily between London and Paris and London and Brussels, more often than not less than half loaded, and at a prohibitive cost in gasoline and oil for their big engines. The fares charged had to be very high and the vicious circle was complete.

The technical results,—mechanical reliability and ability of the pilots to make their way in bad weather in spite of the rather primitive meteorological and other ground services available at that time were surprisingly good, but the financial results were disastrous.

It was not until the French Government heavily subsidized the French lines and enabled them to make a cut of 40 per cent. in their rates, that traffic began to increase; with this assistance, the old war types, uneconomical as they are, took on a further lease of life in France and are still widely used in that country. To enable the British companies to compete, the British Government assisted them by financing the acquisition of modern commercial planes on a repayment basis, and guaranteed a profit. The effect of these steps on the traffic itself is well shown by Table 1. In the meantime the principal constructors had given their serious attention to the problem of increasing the carrying capacity and reducing the running costs and the new machines showed a remarkable improvement in this respect.

It is interesting to note the successive steps toward this realization of the chief commercial requirement, the carriage of greater loads at less expense. Just before the dissolution of the pioneer concern—The Aircraft Travel & Transport Co.—a desperate effort was made to improve matters in this respect. Operations were placed in the hands of traffic experts pure and simple, who, quite justifiably, at once tried to increase the service obtained per week from the equipment in hand, such as it was. Undoubtedly this effort provided a vast amount of data on constructional details such as accessibility of engine installations, ease of repair and all matters which would become especially prominent as more work in a given time was demanded of each aeroplane as a unit. The results only emphasized more respects in which the coming commercial designs had to show improvement over the converted war types, aside from carrying capacity and load space.

The requirements having thus become clearly established, the designers set out to fulfill them. After the 360-hp. DH16, really a converted DH4, carrying four passengers in very cramped quarters, and subsequently the Bat, FK26, which carries a slightly greater load with the same horsepower in a good-sized cabin, this progress in design was very marked in the 450-hp. DH18, carrying eight passengers, which was very soon followed by the Fokker monoplane with five passengers for 185-h.p.. With these the useful load carried per horsepower had advanced from 4 lb. to 8 lb., or an improvement in commercial performance of 100 per cent. The internally braced monoplane, in which the aeroplane finds itself practically reduced to its essential parts, lifting surface, body, chassis and controlling organs comprising the entire structure of the machine, has opened up fields of study in the matter of wing design which promise still further progress in this direction. Within recent months several new designs on this principle have appeared and are in successful operation, which again show an advance in carrying capacity. Notable among these are the new DH29 and the new Fokker F4, which carry from ten to twelve passengers and considerable baggage with engines of 400-450 h.p., the useful load carried per h.p. thus having now advanced to 9 lbs. Roughly, this means that such aeroplanes can carry a load of more than one ton in passengers and freight a distance of 600 miles in 6 hours at a fuel cost of $48, or ¾ of a cent per passenger mile.

The few figures given go to show that the aeroplane, even in its present state of development, is by no means a hopelessly costly means of transportation, provided that facilities for its exploitation are developed to a sufficient extent so as not to entail the addition of entirely disproportionate overhead charges to the actual running cost, charges of a character with which no other form of transportation has to contend or is able to bear. In the following paragraphs a few of the factors governing these charges are discussed.

The Selection of Routes

What has been said gives an indication of the aeroplane's present capacities and also of the trend of development in the near future. The next question is, obviously, where can it be put into regular service with a reasonable expectation that that service will become truly a public utility and receive sufficient support to thrive as a commercial venture?

It may be argued that eventually air traffic will have its place in the scheme of things alongside the older and slower means of transit, wherever traffic of any kind—or at least long distance traffic—exists. However, it is obvious that in choosing the routes to be operated during the introductory period very great care will have to be taken to select those on which the air lines are likely to justify their existence within a reasonably short time. Such routes may be fairly clearly divided into two categories. First, there is the route between commercially or politically important points, of which the development has been so rapid that transportation facilities have been unable to develop proportionately. The new world is full of such opportunities for the aeroplane, the only vehicle which is practically independent of geographical obstacles and does not entail the laying down of a permanent right of way.

Second, there are routes on which terrestrial transportation facilities are very highly developed and the volume of traffic very great, but where at the same time communication is retarded by natural obstacles which do not affect the aeroplane to any considerable extent. Chief among these are mountains and intervening stretches of water entailing either transshipment or circuitous routes.

In either case, the decision that the establishment of air communications is a justifiable venture can only be made after careful study of existing transportation facilities and local conditions. The full support of the foremost industrial and business interests in and around the terminal cities must be obtained; and extensive preliminary canvassing and propaganda work are essential with a view to enlisting coöperation by the community in the establishment of air terminals and other facilities analogous to those provided for shipping, as well as to insure patronage once the air line is in operation.

The public has to be taught how to use the airways; even with air lines in full operation a great deal of publicity work and effective advertising will be necessary to show the business man just how to combine the new transport facilities with the older ones in order to take full advantage of the aeroplane's speed. This is especially the case as long as night flying is not practicable, or rather, not organized and regularly carried out, thereby necessitating the coördination of train and air-service schedules for long distance transportation.

Especially in the early days, the European lines suffered from lack of appreciation of the value of this educative publicity, a fact which contributed immeasureably to their difficulties in obtaining satisfactory loads. Both by this example and the far greater development of the science of advertising in this country, the coming American lines should have a considerable advantage over the European pioneers in this respect.

In the establishment of the first lines many similarities to the early days of railroading will be found, but many of the trials of the latter, both technical and financial, may be avoided. Compared with the railroad, the capital outlay involved in the airline is fractional; the non-requirement of permanent tracks involving the possession of immense tracts of land, will always be among the chief advantages the aeroplane possesses over any other means of overland transportation.

Ground Organization

Nevertheless, real estate values effect the increasing commercial use of the aeroplane to a considerable extent. There is probably no other single factor which has been so effective in retarding the general use of aircraft in this country as the lack of landing fields. Such privately owned flying fields as there are, are in only too many cases small, with obstructed surroundings and inadequate for highly loaded commercial craft. The military fields, which in Europe form the backbone of the airways, are few in the U. S. even including those abandoned after the war; also they are generally located just where the ground happened to be naturally suited for training in flying, far removed from large cities. In Europe important centers were liable to attack by enemy aeroplanes and defensive squadrons had to be stationed close at hand. Even in the case of the European capitals, however, the airports now established on these old military fields are in most cases much father away from the cities than is desirable for commercial flying. If two hours have to be spent in transportation to and from the airports, in order to make a 2½-hour journey by aeroplane, the saving of time over the railroad, at least where the latter provides an efficient and direct service, is practically lost, and the airline is not likely to flourish.

This problem is admittedly in most cases difficult of solution. The nearer the center of a town, the more valuable land becomes; however well financed, the cost of such land suitable as an airport is not one which a new transportation company, which has yet to develop a popular demand for its service, can be reasonably expected to bear. The analogy with docks and harbors, of which the intial cost is borne by the city treasury, is obvious, but it also demanding much from a city's foresight and enterprise to expect it to lock up a great amount of capital in reserving large tracts of valuable land near the business center, of which—especially at first—very scant use will seem to be made. As traffic develops, increased landing fees, hangar rents and other dues will improve the immediate financial aspect, until the time, which may not be so far distant as to be visionary, that long distance airliners will land on platforms covering the stations, yards and part of the tracks of the local railroad lines or even several city blocks.

To a layman, it would seem that in this question of reserving centrally located tracts of land as airports for a number of years there may be much to interest real estate manipulators.

The arrangement of emergency landing fields at short distances apart, along the routes, should not present any difficulties. Their preparation may involve the removal of a few trees and other obstructions and the erection of suitable markings as a guide for pilots when in difficulties due to weather or mechanical trouble, but otherwise they can retain their normal functions if meadow land is selected.

A most important part of the ground organization is the provision of a specialized and adequate meteorological service. A considerable development of the existing Government meteorological institutions or weather bureaus will be necessary, since the information obtainable at the present time is of very little use for air navigation. In Europe, government weather experts and radio services are installed on the principal airports, and reports are obtainable hourly. In England it was so well recognized that air navigation was bound to develop the knowledge and organization of meteorlogical work, that shortly after the war the existing government meteorological office was placed compeltely under the control of the Air Ministry.

Such further auxiliary services as directional radio and beaconing the airways by night will eventually all have to be recognized as a public service and undertaken by the Government; the pooling of facilities by different railroad companies may be a matter of private arrangement and not the concern of the public, but the following of organized airways and the picking up of radio signals will automatically become a public right.

Legislation and Insurance

As is the case with any form of transportation, the perfection of organization, mechanical reliability and standing of personnel ought to be reflected clearly in the terms on which equipment passengers and freight are accepted for insurance by the large companies, and it may be fairly regarded as illustrative of the condition of commercial flying in this country that the state of affairs in aircraft insurance is far from satisfactory.

At present the position of an insurance company called upon to quote on aircraft risks is not enviable. The entire absence of any legislation to place responsibility for even the most elementary consideration of public safety, by controlling the efficiency of aircraft and ground organization, combined with the scarcity of such ground organization in the form of landing fields and auxiliary services, would induce any company to keep clear of taking aviation risks for the present, were it not for the necessity of obtaining experience and statistics as a basis for the business which the development of air transportation on a large scale will eventually offer. As it is, the present state of the aircraft insurance market may justifiably be described as chaotic. Again, risks have been accepted which should never even have been considered, and the consequent losses duly paid, while on the other hand premiums have been quoted which must have been based on a considerable "factor of ignorance," being, apparently, out of all proportion to results already obtained elsewhere under conditions sufficiently similar to those involved in the proposal.

The institution of a system of registration and inspection of aircraft and pilots by the Insurance Underwriters Laboratories is a great step in the right direction. To make the system fully effective, it is to be hoped that legal confirmation of the powers of that body will soon follow. The assignment of such technical duties to a semi-public institution, instead of to a Government department—which principle has a strong precedent in the case of shipping in Lloyds—is in many respects preferable. The rapid development both of the aeroplane and its application may necessitate frequent and urgent changes in existing regulations, with which necessity it will be difficult to keep pace if technical details are incorporated in Federal laws.

The effect which proper legislation will have on the financial stabilization of air transportation in general, both through the creation of reasonable insurance facilities and through the definition of the legal status of the aeroplane and that of its operators, is well illustrated in the case of passenger liability. When legal liability for the safety of passengers and third parties is determined, insurance against these risks will become possible. At the present time the risk cannot be deter-

(*Concluded on page* 503)

TRAFFIC AIRSHIPS WITH SPECIAL REFERENCE TO ECONOMY[1]

By WALTHER LEYENSTETTER

Translated by the National Advisory Committee for Aeronautics

As a result of the progress in the construction of airships during the War, the question naturally arises as to their adaptability to economical transportation.

The airship is expected to enter into competition with the existing means of transportation and to carry on air traffic along with the aeroplane.

In a general way, the following table shows the available fields for aircraft:

Conveying Medium	Water	Land	Air	Electricity
Realm of Transportable weight	Tons 20,000	800	20	
Speed Realm	km/h 5 50	20 150	100 200	1080000000 Km/h
	Boats propelled hy muscle, wind or enginepower.	Passenger cars or trains with or without rails.	Without general economic significance. Only for difficulty accessible points without other transportation lines for urgent delivery of samples, etc.	
Passengers	Ditto	Ditto	Airplanes Airships for communication between places where especially quick travel is necessary or where the ship cost of building other lines is too high. | the increase in speed over land or ship travel is great enough.	
News	Mail	Mail	Air mail, as above for freight and passengers.	Telegraph, Telephone

It follows that air transportation constitutes an organic extension of land transportation, but without the load exceeding 20,000 kg. and without materially reducing the great jump in speed from 150 km/h (electric express) to 1,080,000 km/h (telegraph).

It can therefore seldom be a question of ordinary freight, but chiefly of passengers, urgent letters, samples of goods, etc.

An aircraft line is consequently always able to compete, when it utilizes its advantage (shared in common with boats) of saving the expense of construction and upkeep of railroads.

Their ability to compete is unimpaired when their superiority depends only on the shorter duration of the trip, in connection with which the element of danger and dependence on the weather works to their disadvantage.

Technical Viewpoints

1. Flight Altitude and Efficiency

The propeller thrust P, for a given engine power N_1, is

$$P = \Psi \,.\, \pi \,.\, r^4 \,.\, w^2 \,.\, \frac{\gamma}{8} \quad . \; . \; . \; . \; . \qquad (1)$$

$$N_1 = \mu \,.\, \frac{\pi}{75} \,.\, r^5 \,.\, w^3 \, \frac{\gamma}{g} \quad . \; . \; . \; . \; . \qquad (2)$$

in which μ and Ψ represent numbers dependent on $\frac{v}{r\,.\,\omega}$

r, the propeller radius in m,
ω, angular speed in 1/s,
γ, air density in kg/m³.
g, acceleration due to gravity in m/s².

This thrust equals the total resistance of the aircraft.

$$W = (\Sigma\, \zeta_w \,.\, F + \Sigma\, \xi_w\, J^{2/3})\, \frac{\gamma}{g},\, v^2 \quad . \; . \qquad (3)$$

in which

ζ_w, represents the drag coefficient for surfaces,
F, the frontal surface in sq. m.,
ξ_w, drag coefficient for objects,
$J^{2/3}$, total surface in sq. m.,
v, speed of aircraft in m/s.

If the engine power N_1 and the aircraft speed v remain constant, it follows since all other quantities[3] are invariable and γ/g only appear linearly in equations 1, 2, and 3, that under these conditions the flight altitude of the aircraft makes no difference (with ordinary engines).

For engines with ordinary carburetors, the power diminishes more rapidly than the air density as was found by experiments in the vacuum chamber.[4] For these engines there was a connection between horsepower and air density, according to the equation:

$$N_e = \sqrt{n \,.\, \gamma - m + o} \quad . \; . \; . \; . \; . \; . \qquad (4)$$

in which n, m and o are known.

Overdimensioned and high compression engines lie at an altitude of 2500 m. The variations in consumption are so small up to 3000 m. that, from the standpoint of efficiency and fuel economy, high compression engines are the best for airships.[5]

The endeavor to maintain the greatest possible economy of fuel, independently of the air density, is manifested by its reaction on the propeller.

To obtain the highest propeller efficiency is less important

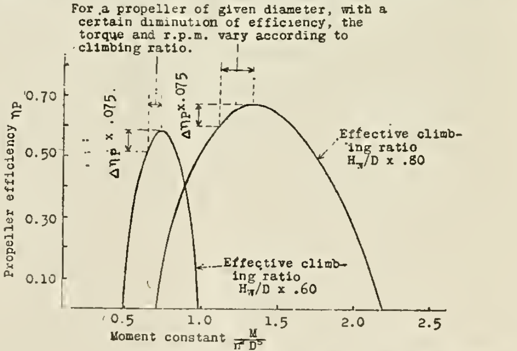

Fig. 1. Propeller efficiency in terms of the moment constant.

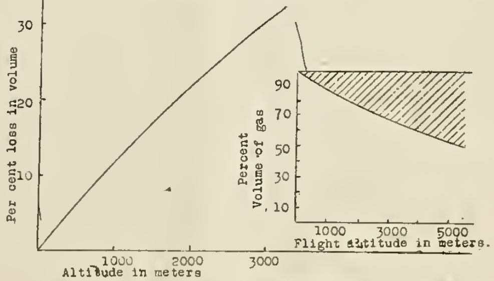

Fig. 2. Utilizable volume of gae dependent on the flight altitude.

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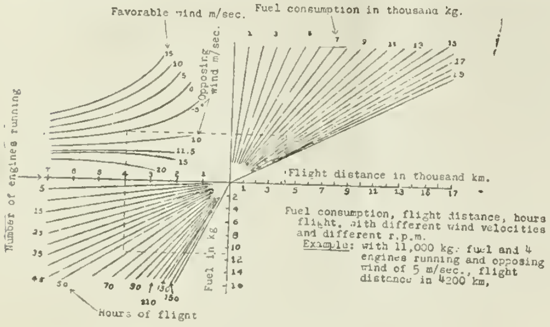
[1] Taken from "Zeitschrift für Flugtechnik und Motorluftschiffahrt," October 30, and November 15, 1920.

[3] This does not hold quite true for ζ_w and ξ_w. Since, however, tests have not yet been made of the changeability of these two values for changing v/g and it may be assumed that Ψ and μ change in quite similar manner, they may be here regarded as constant.

[4] See "Zeitschrift des Vereines Deutscher Ingenieure," 1919, Vol. 63, W. G. Noack, Airplane Superchargers, p. 995 (For translation see N. A.C.A. 3161-32), and T. B., Vol. III, No. 1, pp. 1-10. (For translation see N.A.C.A. 3001 Daimler /2).

[5] See "Zeitschrift für Flugtechnik und Motorluftschiffahrt," 1920, No. 10, p. 137, "Der Flugmotor in Verschiedenen Luftdichten," by O. Schwager, and "Zeitschrift für Flugtechnik und Motorluftschiffahrt," 1920, No. 13, p. 185, "Hohenleistung von Verbrennungsmotoren," hy Wilcke.



Fuel consumption, flight distance, hours flight, with different wind velocities and different r.p.m.
Example: with 11,000 kg. fuel and 4 engines running and opposing wind of 5 m/sec., flight distance in 4200 km.

Fig. 3.

in itself than to adapt the propeller output to the working conditions of the engine.

The influence of the variations in torque and r. p. m. on the efficiency of propellers is shown by Fig. 1, which is taken from the publications of Schaffran ("Zeitschrift für Flugtechnik und Motorluftschiffahrt," 1917, pp. 49, 93 and 109) on systematic propeller experiments.

From this figure it is manifest that if the revolution speed n, and the diameter D are constant, then the efficiency π_p is greatest for a given torque M.

The field within which π_p changes by like amounts, constantly increases with the effective climbing ratio H_w/D. When, therefore, the revolution speed n and the diameter D remain constant, it is advantageous to take the effective pitch and therewith the speed vr as great as possible, since with a large H_w/D the absolute value of the propeller efficiency π_p increases, as also with decreasing engine power, L $(M = 71620 \frac{N}{n}$ — π_p decreases less than with a small H_w/D (narrow-bladed propellers).

For small variations in the r. p. m. and in torque, the decrease in propeller efficiency is of subordinate importance. The increase in the r. p. m. of the propeller, due to increasing air density with constant engine power, demands however special measures.

The variation of the propeller speed through

(a) a variable gear-shift, has the disadvantage of increased weight, considerably more noise and objectionable acceleration of the propeller in thin air.

(b) regulation of the engine speed, has the disadvantage of increasing fuel consumption by departing from the most favorable r. p. m., and of vibrations of the whole engine group on approaching the critical r. p. m.

The most promising method is by changing the pitch of the propeller[8] in order, with changing air density, to retain approximately the same efficiency.

Tested specimens of adjustable blades designed by Helix, Hirth, Lorenzen and others have demonstrated their practicability and the possibility of making them of other materials than wood.

While an aeroplane in climbing requires an increase ΔL in the engine output per second

$$\Delta L = G \sin \Phi \cdot v_s \quad . \quad . \quad . \quad . \quad (5)$$

in which G = weight of aeroplane,

Φ = climbing angle,
v_s = climbing speed,

an airship has a constant lift up to a certain altitude. The choice of this altitude has a bearing on the percentage composition of the gas at the starting point.

In accordance wih the barometric altitude formula, without reference to temperature changes, we have:

$$H^1 - H = 18{,}400 \log \left(\frac{1}{1 - \frac{V^1}{V}}\right) = -8{,}000 \log nat \left(1 - \frac{V^1}{V}\right)$$

in which $H^1 - H$ is the difference in altitude up to which no blowing off shall occur,

V, the gas volume at beginning of ascent,
V^1, increase of gas volume at altitude H^1,
hence $V + V^1$, total gas volume of airship.

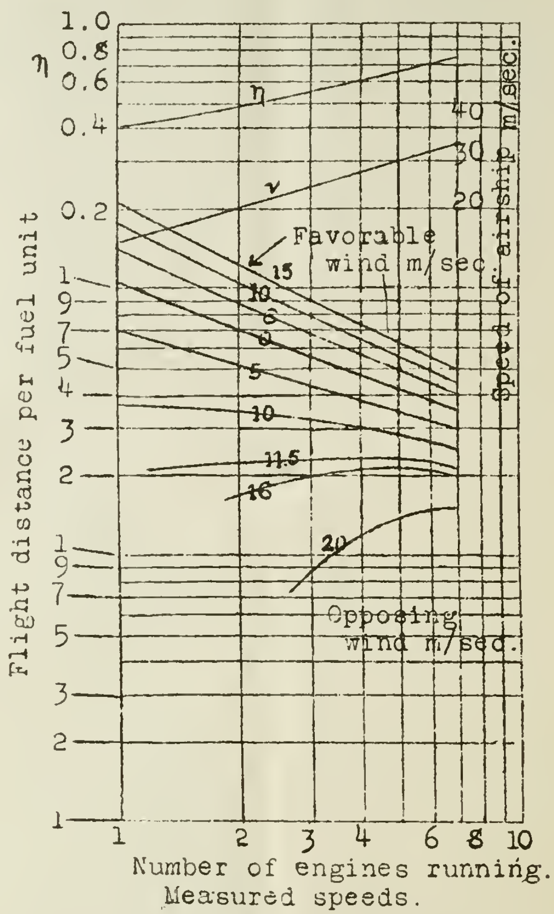


Fig. 4 measured speeds.

From the above equation follows

$$\frac{V^1}{V} = \frac{H^1 - H}{8000} - \frac{(H^1 - H)^2}{8000^2 \cdot 2} + \frac{(H^1 - H)^3}{8000^3 \cdot 6} - \frac{(H^1 - H)^4}{8000^4 \cdot 24} + \quad (6)$$

$H^1 - H = 500, 1000, 1500, 2000, 2500, 3000, 4000, 5000$ m.

$$\frac{V^1}{V} = 6.06, 11.77, 17.1, 22.1, 26.8, 31.3, 39.3, 46.4\%$$

Fig. 2 shows the utilizable gas volume in terms of the flight altitude. A partially inflated airship always has the same supporting power both in ascending and in descending. A full airship loses about 1% of its total lifting power for every 100 feet of ascent. Mechanical aspect of a full airship is always uneconomical, resulting in a loss of both fuel and efficiency.

With reference to engine power and propeller efficiency, as well as for avoiding needless loss of gas, we are restricted to a maximum difference of about 2500 m. between the starting and flight altitude.

2. Flight Speed

The necessity for war aircraft to reduce the air resistance, has exhausted the possibilities so far that the limits in the practical production of streamlined coverings and in the accessibility of important parts are rather to be sought, than the elimination of drag-producing bodies.

The case is similar as regards weight reduction. Still there are possibilities here for improvements in the further development of girder construction, the employment of more suitable materials, etc.

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[6] Article by Prof. C. Eberhardt in "Motorwagen," 1919, p. 309, on adjustable propellers.

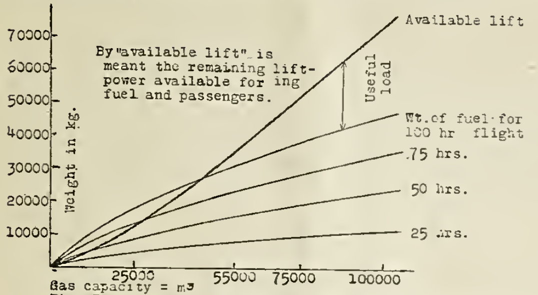

Fig. 5. Available lift, useful load and weight of fuel for rigid airships'

The connection between weight and drag, if aircraft of like speeds are compared, is determined by the saving in power for a lessening in drag. In general it is

$$W = \frac{75 \,.\, N \,.\, \pi}{v}$$

in which W = drag of aircraft,
v = speed of aircraft,
N = total engine power,
π = efficiency of aircraft.

With constant aircraft speeds, the horsepower of two aircraft may be compared by the formula

$$N_2 = \frac{W_2}{W_1} N_1$$

in which

$$W_2 < W_1$$
$$v_2 = v_1$$

If G_{bo} is the fuel and oil consumption per HP and per hour, and t is the flight time in hours, then the fuel saving for any drag diminution is given by the formula

$$\Delta G_{bo} = G_{bo} \,.\, N_1 \,.\, t\left(1 - \frac{W_2}{W_1}\right) \quad . \quad . \quad . \quad (7)$$

It is here assumed to be a question of only small changes in drag and that, in throttling the fuel, only an insignificant loss of efficiency of the engine occurs.

If then $W_2 > W_1$ and $v_2 > v_1$, the increase in fuel consumption with increased aircraft speed is

$$\Delta G_{bo} = G_{bo} \,.\, N_1 \,.\, t\left\{\left(\frac{W_2}{W_1}\right)^{3/3} - 1\right\} \quad . \quad . \quad . \quad . \quad . \quad (8)$$

If we wish, with traffic aircraft, to adopt an arrangement which, with small space for passengers and freight, will enable the reduction of the total drag, the question arises as to whether, in the particular instance, it is more economical to reduce the flight time or the weight of fuel.

It follows from the above that (for a small reduction in drag, resulting from the saving in fuel due to the engine) it is economical to throttle the engine.

These considerations lead in general to the inquiry, in the case of streamlined bodies, as to what relations there are between content J, surface O, and drag coefficient ζ_w.

The investigations of Prandtl-Fuhrmann, which must be considered fundamental, are based on models having the same cubical contents and the same surface (Hütte I, 1915, p. 359).

From a purely theoretical point of view, the best shape would be that offering the least total resistance for a given capacity. Nevertheless the spindle-shaped body with the best drag coefficient is not the most favorable for the construction of an airship. According to whether it is rigid or non-rigid, it must be determined when, with a constant capacity J, the surface O (for non-rigid) and the weight G_s (for rigid airships) is the smallest. Above all else, its controllability and matters pertaining to the hangar play the deciding role.

For ascertaining the most favorable flight speed[7] it is necessary, for the sake of economical operation, to be able to change the aircraft speed at will, without loss of power. Such speed changes are effected through switching individual engines on or off.

The attempt to calculate the distance flown with different numbers of engines running, on the assumption of unvarying efficiency, offers no prospect of success, since π (as shown by Fig. 4) is greatly affected by changes in the speed of the aircraft.

3. Distance Flown and Useful Load

The expression of the useful load with reference to the distance flown is derived from Professor Parseval's formula.

If the drag-weight ratio of the aircraft is K^1 (ratio of drag W to weight G), then $W = K^1 G$.

It has been found that 1/8 may be assumed for a good aeroplane. With a propeller efficiency of $\pi p = 0.75$, the work done by the engine during a flight s is:

$$A = s \,.\, G \,.\, 0.167$$

Now one HP generates 270,000 kgm/h = 0.27 kmt/h and consumes about 0.25 kg/h of fuel and oil. Hence for generating 1 kmt we require $\frac{0.25}{0.27} = 0.93$ kg with a throttle loss of about 1 kg of fuel. The fuel consumption

$$B = s \,.\, G \,.\, 0.167 \,.\, 1 = s \,.\, G \,.\, 0.167 \text{ kg.}$$

The fuel consumption during flight results in a loss of weight d G:

$$-\, d\, G = G \,.\, d\, s \,.\, K \; (K_{aeroplane} = 0.000167 \text{ for } G \text{ in tons}).$$

Hence

$$s = \frac{1}{K} \,.\, ln \left(\frac{G_0}{G}\right)$$

in which G_0 = weight of aircraft at start,
G = weight of aircraft at finish.

If the fuel load is placed at 20% and the useful load is likewise placed at 20% of the total weight, then the distance flown by the aeroplane in still air is $s_{aeroplane} = 1380$ km (which is a very favorable calculation).

In the case of an airship, W is constant.

With a propeller efficiency of $\pi p = 0.75$, the work done by the engine for the flight distance s is

$$A = \frac{s \,.\, W}{\pi\, p}$$

and the fuel consumption

$$B = A \,.\, 1 = 1.33 \,.\, s \,.\, W \text{ kg.}$$

If we take $\frac{1}{32.5}$ as the ratio of drag to total lift, then with a fuel load equal to 20% of the total load, the distance flown by the airship will be s = 4880 km.

Since, however, we have the ratio

$$\frac{\text{total lift}}{\text{own weight}} = \frac{100}{40}$$

with the unfavorable system of the rigid airship for useful load, 30% and more can be reserved for fuel. (For 30% fuel load, $s_L = 7330$ kg).

The drag of an aeroplane is generated chiefly by the supporting surfaces. Any considerable improvement in the ratio of the drag to the weight is therefore not to be expected through enlargement of the dimensions of an aeroplane and any increase in its economical radius of action in this manner does not appear possible.

If we now consider the radius of action of airships, the comparison of useful load and fuel load for rigid airships in Fig. 5 shows immediately that on long voyages an extraordinary decrease in weight results from the consumption of fuel.

For example, it amounts to 15,000 kg. for a 55,000 cu. m. airship in 50 hours of flight. As a result of this lightening, the airship climbs

$$\Delta H = 18{,}400 \log \left(1 - \frac{g}{G}\right) \text{ meters}$$

in which g = loss in kg.
G = total weight of airship in kg.

$$\Delta H = 18{,}400 \log \left(1 - \frac{15{,}000}{64{,}000}\right) = 1620 \text{ meters.}$$

If the equilibrium altitude were 2500 m. on starting, the loss of gas in climbing 1620 meters higher would amount to

$$0.145 \,.\, 55{,}000 = 8000 \text{ cu. m.}$$

The avoidance or diminution of this loss of gas resulting from the fuel consumption constitutes an important problem in solving the question of airship transportation in the economical sense.

As a means of obtaining ballast, we have the air, the exhaust gases, and the fuel itself at our disposal. The utilization of the air and the moisture it contains for obtaining ballast is impracticable, on account of the apparatus required and the often small proportion of moisture present.

From the combustion of gasoline and benzol, water and carbon dioxide are obtained. These combustion products must be reduced to a minimum volume and normal temperature before they can be utilized as ballast.

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[7] P. Renard, Les voyages economiques en aéronef (La technique aéronautique, 1910, Vol. 11, p. 1) and C. Wieselsberger, Göttingen (Zeitschrift für Flugtechnik und Motorluftschiffahrt," 1913, p. 16) have drawn the power curves in terms of the aircraft speed and determined graphically the most favorable flight speeds.

Without going into the details of the known chemical and thermodynamic processes within the engine, we can call attention to the normal heat balance of an airship engine:

25.75% useful energy,
24.50% radiator water loss,
39.80% exhaust gases,
3.50% radiation,
6.45% friction and change of form.

From one kilogram of fuel 0.69 to 1.8 kg. of combustion water can be theoretically obtained (1 kg. C H yields theoretically 1.46 kg. water at 15°C and 760 mm. Hg.). Practically, with a variation of the air excess between 10% and 20%, we can expect to obtain about 90% of the theoretical combustion water.

The calculation of a plant for recovering the water contained in the exhaust gases is based on the normal radiator dimensions. The relative radiator efficiency decreases with increasing flight speed.[8] The drag of the radiator and the velocity of the air through the radiator are diminished by an air scoop placed in front of the radiator.

The airship drag W (equation 3) is:

$$W = \frac{75 \,.\, \pi \,.\, K \,.\, N}{v} = (\Sigma\, \zeta_w \,.\, F \,.+ \Sigma\, \xi_w \,.\, J^{2/3}) \,.\, \frac{\gamma}{g} \,.\, v^2$$

in which π = efficiency of airship.
K = r.p.m. of engine,
N = HP of engine.

The front surface F of ordinary radiators on different aircraft, provided with like engines of 245 HP, was

For aeroplane with $v = 50.0$ m/s, $F = 0.203\text{m}^2$.
" airship " $v = 29.3$ " $F = 0.600\text{m}^2$ without air scoop.
" " " $v = 34.6$ " $F = 0.600\text{m}^2$ with air scoop.

For the front surface of radiators

$\zeta_w = 0.53$ for 50 m/s.
$\zeta_w = 0.50$ for 35 "
$\zeta_w = 0.495$ for 30 "

A favorable speed for the radiator efficiency is generated in the radiator by the air scoop. Experiments with radiator air scoops in the bow of the engine nacelle demonstrated that the radiator drag was diminished 57%.

In order, with an airship engine, to remove 24.5% of the total amount of heat by means of the radiator, the latter's share of the total drag area at 34.6 m/s flight speed with radiator air scoops was

$$\Sigma\, \zeta_{wK} \,.\, F_K = 0.43 \,.\, 0.50 \,.\, 5 \,.\, 0.60 = 0.646 \text{ m}^2$$

For cooling the exhaust gases, a further 36.5% of the heat had to be removed by the radiator.

We have no experimental values for gas coolers with air scoops.

We assume in advance (in order not to make too favorable calculations) that the front surface of the radiator had to be exposed to the full flight speed and we obtained for the radiator, as its part of the drag area

$$\Sigma\, \zeta_{wK} \,.\, F_K = 0.50 \,.\, 5 \,.\, 0.60 \,.\, \frac{0.365}{0.245} = 2.235 \text{ m}^2.$$

The flight speed v with ordinary coolers or radiators is

$$(\Sigma \zeta_w \,.\, F + \Sigma \xi_w \,.\, J^{2/3}) = 12.75\text{m}^2.$$

$$v^3 = \frac{75 \,.\, 0.72 \,.\, 5 \,.\, 245}{12.75 \,.\, 0.125} = 4140$$

$$v = 34.6 \text{ m/s}.$$

For airships with gas coolers the speed v g was:

$$v\, g^3 = \frac{75 \,.\, 0.71 \,.\, 5 \,.\, 245}{(12.75 + 2.235) \,.\, 0.125} = 3480$$

$v\, g = 32.65$ m/s instead of
$v = 34.6$ m/s without exhaust gas cooler.

By installing a gas cooler, the ship's speed was accordingly reduced 2 m/s, an amount which could probably be reduced to 1.4 m/s by using air scoops. Air scoops naturally add weight, but have the great advantage, in temperature and speed variations, of keeping the drag at a minimum on account of their streamlined shape.

4. Practical Experiments Have Thus Far Given the Following Results

(a) A gas cooler without air scoop, with about 2 sq. m. front surface, was installed on an airship with a speed of 20 m/s, and delivered about 100% of the weight of the gasoline consumed.

The efficiency was very good, but the thin channels soon rusted and could not be cleaned during the trip.

(b) In order to lessen the air resistance, the cooler (or radiator) was installed in the nacelle as a "rotor" and was expected to draw its own cooling air. It was thought to save energy by driving the rotor direct from the engine.

After several unsuccessful attempts, one experiment produced about 6% of the weight of gasoline consumed, in the form of water. This rotary exhaust cooler with 20 h.p. drive was too small. The channels, which were considerably larger than the ones in the stationary gas cooler, became clogged with rust after a few hours' use. It was difficult to collect the emerging water as it was immediately evaporated by the draft from the rotor. A larger plant would occupy too much room in the nacelle.

(c) Experiments in condensing the water vapor in the exhaust gases by means of a spray of water are being tried and have given 60% of the fuel weight, as the gain in water.

Methods a and c are the most promising. With a maximum energy outlay of 20% of the total engine power, an efficient water ballast winner can be operated.

The attempts to obtain the CO_2 in the form of ballast, by spraying milk of lime into the exhaust pipes, or absorbing the CO_2 with charcoal or coke, failed on account of the impossibility of chemical regenerations during the voyage.

(To be continued)

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[8] In Automotive Industries, Vol. 15, p. 479, aeroplane radiator experiments are described, inaugurated at the Bureau of Standards in Washington, D. C., by the National Advisory Committee for Aeronautics, in which their head resistance or drag, their resistance to the passage of the air current and their weight with relation to the cooling effect was determined. The ratio of *heat energy lost* to *horsepower expended* varied for flight speeds of
29.6 m/s from 17 to 27.5,
34.0 " " 13 " 22.5
according to the kind of radiator.

Commercial Aviation in Montana

Putting commercial aviation in Montana on a successful business basis was worked out during the past year by the Aero Miles City Club of Miles City, which proved to the skeptical public that such an undertaking can be carried on with profit in this part of the country. The Club's operations were carried on by pilots A. W. Stephenson and E. T. Vance, both of whom were officers in the U. S. Air Service during the war. These pilots flew two Curtiss Standards and a Curtiss JN4, and deserve much credit for making the season successful. The Club derived its revenues from a large number of splendid exhibitions at the Montana State Fair and similar fairs in Montana and Wyoming, and from passenger business and instruction school.

The Aero Miles City Club is the pioneer in the field in the State and is doing all that is possible to promote the right kind of commercial aviation. Miles City has a good landing field and an effort is being made to have every town in Montana work out a field which can be used regularly.

A University Course in Meteorology

For the past three years a course in weather science applied to aeronautics has been given in the University of California at the Southern Branch located in Los Angeles. The present year at the University started Sept. 13 with a large enrollment of freshmen and sophmores and bids fair to eclipse the preceding years in interest and accomplishment. The majority of the members of the class are students in the engineering department of the University. Sixty-nine members are taking the course in aeronautic meteorology.

The object of the course is to make the students thoroughly conversant with the principles and practical application of meteorlogy applied to aeronautics.

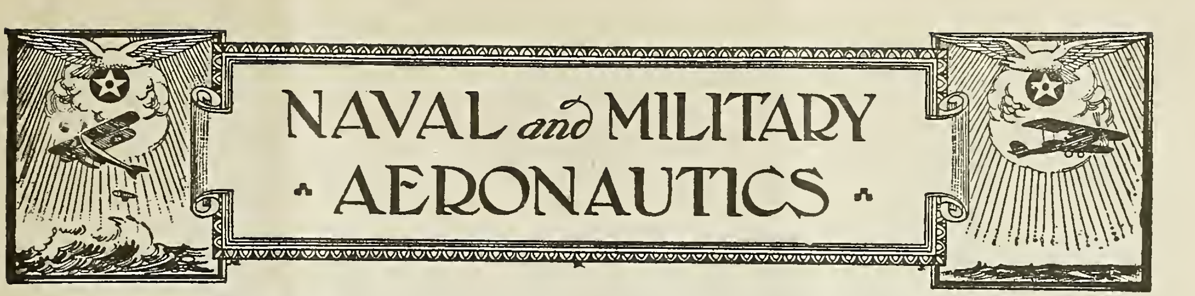
Spokane News

Spokane—Renewal of the lease of the Parkwater aviation field is asked of the Spokane park board by C. H. Messer, president of the United States Aircraft corporation, which has had control of the field two years.

Mr. Messer told the board that his company had constructed a hangar at a cost of $3500 and had spent nearly $500 in clearing the land and had installed an oil and gas station where visiting flyers could get service. In the past 2 per cent of the gross receipts of the field has gone to the city.

Mr. Messer proposes that charges for services at the field and receipts from the field, with the exception of money actually taken in by the company itself, be turned over to the city.

Messer plans to throw the field open to all flyers with the stipulation that local commercial flyers should pay the city a proportion of their earnings.



NAVAL and MILITARY AERONAUTICS

Engines on the Airship Roma to Be Changed

Work has been started with a view to replacing the Italian Ansaldo motors on the Airship ROMA with the American Liberty engines. The Ansaldo is an excellent engine, but due to the lack of trained mechanics who understand this engine, a great deal of difficulty has been experienced in operating same. This has accounted for the delay in the Christening ceremonies, scheduled to be held at Bolling Field on Saturday, December 17th, but which did not take place until December 21st. On that day the airship flew to Bolling Field from Langley Field, after bucking a strong head wind for 5½ hours. Miss Fenrose Wainwright, daughter of Assistant Secretary of War Wainwright, broke a bottle of liquid air on the bow of the semi-rigid airship, following which the official transfer of the airship to the United States, for which Italy was paid $185,000, was made by Ambassador Ricci to the Secretary of War in a speech extolling Italian-American friendship. Then followed the presentation of the new battle pennant to the Assistant Secretary of War by Lieut.-General Vaccari of the Italian Army, and an inspection of the ship, General Patrick, Chief of Air Service, conducting the officials and other invited guests abroad for a view of the spacious operating room, with its two helms, one on either side, its window-lined cabin and the long passage way provided in the keel of the ship.

The sight-seeing trip over Washington and to Baltimore, which was originally planned, was called off by General Patrick after a consultation with the commander of the ROMA and the officials of the Weather Bureau, in view of a threatened increase in the wind and general rough weather for aerial cruising, also engine trouble.

Leaving Langley Field at 6:30 a. m., Major J. G. Thornell, commander of the ROMA, made the trip up most of the way on three engines against a strong northwest wind. He flew low and had some difficulty in negotiating the hills surrounding Bolling Field after he turned to the west in preparation to land.

The Secretaries of War and of the Navy, with Ambassador Ricci of the Italion Embassy, awaited with a big crowd of Army and Navy officers and guests for nearly three hours in the cold and wintry blasts which swept over the field. The monotony of the long wait was broken at frequent intervals when the Army Band, which played in an American and Italian flag decked stand, rendered various selections, and Lieut. Wolfe gave the crowd some thrills in his display of acrobatics in an SE5.

When the airship was moored on the ground, the squalls were so strong that a kite balloon had to be deflated so as to avoid its destruction.

The ROMA itself functions excellently, as this flight to Washington amply demonstrated, the ship arriving with only four of the six motors functioning, and one of these four running very poorly. The radiation surface of the Ansaldo engine is very large, due no doubt to the fact that the climate in Southern Italy, where the ROMA was originally flown, is much warmer than that around Langley Field and Washington, and on the trial flights of the ROMA, as well as on the official flight to Washington, these motors had a tendency to 'freeze." Considerable difficulty was also encountered because of the fact that they ran very oily. The principal reason, however, leading to the decision to supplant the Ansaldo with the Liberty is that it is contemplated in the near future to have the ROMA make a number of long distance flights to Scott Field, San Antonio, Texas. It is anticipated that eventually these flights will be extended to the Pacific Coast, as soon as hangar facilities are made available in that locality.

The hangar at Brooks Field is nearly completed, and concrete foundations are already set for the large hangar at Scott Field. On these long flights the motors will be running continuously from 24 to 48 hours and it will, of course, be necessary that they be completely overhauled at each of the operating stations, making it essential to have replacement engines at these stations in order that engines may be removed from the outriggers and replaced with new or overhauled ones. This procedure will only be possible with complete replacements at the various stations of Liberty engines, as the ROMA has only two spare Ansaldo engines. Then, again, the Air Service mechanics all understand the Liberty engine; spare parts are available at every Air Service station in the country; and it is anticipated that when the Liberty engines are installed there will be no more engine trouble on the dirigible.

It is expected that the maximum air speed of the ROMA with the new Liberty engines will be nearly 75 miles an hour, which will, of course, enable her to fight any wind that she may encounter and arrive at her destination without mishap.

Since the ROMA has beeen assembled in this country, a completely equipped radio room has been installed therein. During its entire flight from Langley to Washington and return she was in communication with both Bolling Field and her home station. There is also being installed a completely equipped photographic room, in which vertical photographs may be developed and printed within 30 minutes and delivered by parachute to any station over which she flies. With her photographic equipment, the ROMA will also be able to take excellent airscapes much more satisfactorily than they can at present be taken from aeroplanes.

The ROMA will be used as an instruction ship for the Airship School at Langley Field, where students who have graduated in one-man and two-man control airships will be given advanced instruction.

The Army Air Service is greatly pleased with the performance of the ROMA and feels that great strides in the development of our lighter-than-air program will be possible due to the experience gained in the operation of this ship.

Major Lackland's New Assignment

Major Frank D. Lackland, Air Service, recent graduate of the Engineering School at McCook Field, Dayton, Ohio, has taken up his new duties as Air Officer, Eighth Corps Area, relieving Major Carl Spatz, who has taken command of Ellington Field and of the First Pursuit Group. Major Lackland is amidst familiar surroundings, as his primary training was received at Kelly Field.

Art Smith an Instructor at Carlstrom Field

Carlstrom Field now has in point of experience one of the oldest civilian flyers in the United States. Mr. Art Smith recently arrived at the field, flying there from McCook Field. The trip was made in nine days—sixteen hours flying time—covering 1180 miles. Mr. Smith will instruct a class of five student officers in the class beginning January 1st, using his specially equipped dual-controlled JN4H Curtiss. His students will be checked at five hour periods and their progress noted. The Flying Department will keep a record of their progress to determine the merits of Mr. Smith's system over the Gosport system used at the field.

Reserve Aero Squadron at San Jose

The reserve squadron now being organized at San Jose, California, is entering upon an active recruiting campaign, as a result of which they expect to get considerable material of a high standard. Crissy Field is aiding in this campaign, having sent to San Jose its mobile machine shop, and Photo Section No. 15 mobile photographic truck and trailer. Major George H. Brett, Commanding Officer of Crissy Field, accompanied by Mr. Spiegel, a former Captain in the Air Service, 1st Lieut. F. D. Hackett and 1st Lt. R. S. Selff made a trip to San Jose in furtherance of the organization of this squadron, Major Brett gave an impromptu talk on Reserve Squadrons as well as the value of same to the community in which they are located. A very enjoyable get-together dinner was served, and during the course of the evening plans were devised for the future of the organization. Hope is entertained that San Jose will be able to furnish a suitable flying field so that the progress of this organization will not be retarded.

Fokker Achievement

According to London newspapers, Fokker, the famous Dutch aeroplane designer, who gave his name to the German fighting aeroplanes, has now invented and built a motorless aeroplane which can be towed behind an air express and "slipped" when over an intermediate air station. A pilot sits in the "aerial trailer," and after it is "slipped" by the engined air express, will guide it down to land. Thus it will be possible, it is said, for an air express on a journey from London to Brussels to drop passengers at Ostend without landing there, as a railway express train drops "slip coaches."

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A joint meeting of the Pennsylvania Section, Society of Automotive Engineers and the Aero Club of Pennsylvania, was held at the Engineers' Club, evening of December 22nd. The engineers and business men of Philadelphia and vicinity were afforded a rare opportunity to learn of the latest developments in commercial aerial navigation, both in this country and abroad.

The meeting was one of a series being held in various parts of the country by the Society of Automotive Engineers and other interested bodies with the object of bringing out the true facts and clearing away any misapprehensions and ungrounded fears which may exist in the public mind with regard to aerial navigation as a business proposition.

Three unusually good speakers had been secured for the meeting. Mr. E. H. Shaughnessy, the Second Assistant Postmaster-General, in charge of the Air Mail Service, brought out some new facts about the usefulness and the real place of this branch of the postal service. Mr. William B. Stout, a widely known aviation engineer and designer, presented a very comprehensive paper on the "Requirements of the Commercial Aeroplane," with some figures on operating costs which proved very interesting. Mr. Ralph H. Upson, a balloon and dirigible expert who has had a great deal of experience both in the United States and Europe, outlined recent European developments in commercial aerial navigation.

As an added atraction, the Navy Department's films, showing the bombing of the former German battleships off the Virginia Capes last summer, had been secured for the meeting. These films have never been exhibited to the general public, being loaned to a few engineering and technical societies, and it was, perhaps, the only opportunity Philadelphians had or will have to witness them.

An informal dinner was given at the Engineers' Club, just preceding the meeting, in honor of Mr. Shaughnessy and the other celebrated speakers. A large audience was in attendance. Mr. Stout's talk on some of the wonderful work being done at the engineering laboratory and the samples of duralumin which he exhibited were intensely interesting.

On January 6th the spectacular feat of linking the two cities—Philadelphia and Camden—by a ribbon carried by aeroplane was performed as part of the celebration of the beginning of work on the great bridge which in a few years will connect those cities.

Just before the firing of the salute by the flagship Olympia, a plane from the Philadelphia Navy Yard, the N. 9, in command of Lieutenant A. C. McFall, and carrying Lieutenant R. Emerson as passenger, flew over Camden and released a parachute with the Camden colors. A similar parachute with appropriate colors was dropped while the plane was over Philadelphia.

In their flight across the Deleware, Lieutenants McFall and Emerson let out a long ribbon streamer, with a wire center to prevent breakage, which had been made by the women workers of the Naval Aircraft Factory. When the two cities had been connected by the streamer the Olympia fired a salute. The ribbon was a marker where later the great steel cables of the largest suspension bridge in the world will tie the two cities together.

Flying far above the N. 9 in its flight up the river was Commander H. C. Richardson, of trans-Atlantic fame, in another one of the Navy planes. The feat of flying the wire center ribbon was regarded as extremely difficult and dangerous, and it was only after considerable practice that word was sent to the Bridge Commission that the feat could be done.

On the eighteenth anniversary of the first human flight greetings, in the name of the Aero Club, were sent to Mr. Orville Wright, who on December 17th, 1903, made the first flight ever accomplished in a heavier-than-air machine. A most courteous, personal letter of acknowledgment was re-

(*Concluded on page* 503)

FOREIGN NEWS

French Aeronautics

It is understood from correspondents that the French Government plans to spend about $25,000,000 on civilian and commercial aviation in 1922. Of this amount $6,000,000 will be used for subsidies to the various French lines operating in Europe and Africa. The rest will be devoted to providing airways, airdromes, sheds, lighthouses, radio and weather reports.

The activities of the French subsidized air transport lines embrace routes: from Paris to London, Brussels, Amsterdam, Prague and Warsaw; from Bordeaux to Marseilles and Genoa; from Bayonne to Santander; from Toulouse to Casablanca and Oran; from Bucharest to Constantinople; from Antibes to Tunis; from Algiers to Biskra; from Dakar to Kayes, and two other lines in French Guiana. This represents roughly 6,100 miles flown over by recognized and regular French air lines.

It is reported that French civilian aerial transport companies from Jan. 1, 1920 to Oct. 1, 1921, have flown 2,070,000 miles and carried 20,300 passengers, with only 3 serious accidents.

The Committee for Aeronautical Propaganda (France) has offered a prize of one million francs for the best airplane motor, combining qualities "indispensable in a commercial engine." Tests will begin June 1, 1923. The Aviation Commission and the French Aero Club will draw up rules for the competition which will be open to foreigners, who, if they are awarded the prize, must undertake to manufacture the motor in France.

Admiral Fournier has communicated to the French Academie des Sciences an account of successful tests of apparatus for the guidance of planes to their aerodromes by night or in fog carried out at Villacoublay by Lieutenant Loth of the French Navy.

After more than a year's work Lieutenant Loth, who worked out a system of guiding ships into port in the thickest fog by wireless a couple of years ago, has devised a similar apparatus for planes which adds less than 10 lbs. to the weight of the machine. On ground there is a guiding cable with an alternating current of 600 vibrations per second. In the machine there are three receiving devices. One of them records a deep and loud musical sound—which the pilot hears with the aid of ear-pieces fixed in his helmet—so long as the machine is flying parallel with the cable. The sound diminishes when the direction of the machine makes an angle with the cable and ceases altogether when the direction is at right angles to the cable. The second spiral records its loudest sound when the machine is flying at right angles to the cable and ceases to record when the plane is going parallel. The sound recorded by the third spiral varies according to the distance of the machine from the cable, but it stops dead the moment the machine crosses the cable. The sounds can be caught as high up as 10,000 ft. and for a mile and a half on either side of the cable.

The first experiments failed because the sounds were drowned by the noise of the motors, but ear-pieces fixed in the helmets have overcome this difficulty.

The Paris-Bucharest air line now in operation requires 14 hours between the two capitals, including stops at Strasburg, Prague, and Budapest. It requires 63½ hours by the fastest train.

German Aeronautics

Eight German civil air lines are operating a total of 103 planes.

The Minister of Transport has decreed the suspension of subsidies for the German air mail services during the winter, because "the machines and present ground organization do not meet the requirements for winter operation, and because of the impossibility of increasing the number of aircraft as long as their construction is prohibited by the Allied Council."

By consent of the Dutch Government, two aviation schools have been opened under the supervision of German flying officers, in the Dutch East Indies.

Aeronautics in Switzerland

It is reported that a plant for the construction of a two-seater all metal Dornier sport seaplane has been erected at Rorschach, Switzerland, by a Swiss by name, M. Eggensperger.

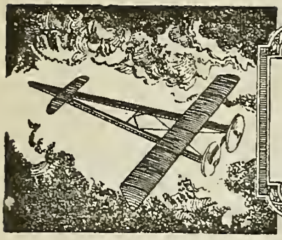
The Swiss Government intends to establish an air mail line this year connecting with all the international air routes.

The Spain-Argentine Service

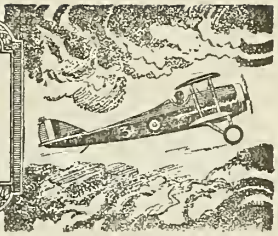
A mission composed of three Spaniards and two Germans have been in Buenos Aires, Argentine, since September, negotiating with the Government over the proposed airship line between Spain and Argentina. Terminal facilities and a subsidy, or other financial support, are among the matters being negotiated.

Japan to Study Flying

An Aviation Technical Institute and Aviation Council have been appointed under the Minister of Education. The institute will be attached to the Tokio Imperial University. The Minister of Education will be the president of the Council which will have 20 professors. Its duty will be "to deliberate upon important matters concerning the basic theoretic principles of flying machines."



ELEMENTARY AERONAUTICS *and* MODEL NOTES



The Effects or High Altitudes

ON account of the low temperatures encountered at high altitudes, the normal radiator area necessary near the ground becomes too great. Radiators are therefore usually provided with adjustable blinds composed of a series of narrow shutters, by means of which the cooling area of radiators can be controlled.

There is also another very important reason for this device—in order that the machine can come down, the engine must be practically shut off and consequently little heat is supplied to the cooling water circulating through the radiator. At the low temperatures met with, were the greater portion of its area not screened, it would quickly become frozen and cause the engine to overheat when the power was again put on.

Man is affected by altitude in much the same manner as an engine. The human body depends for its energy on the consumption of oxygen. As the density decreases, so does the amount of oxygen drawn in at each breath. As the altitude increases the rate of respiration increases. This, of course, cannot go on indefinitely. At a height of 16,000 feet the normal body has become a very poor machine. It is capable of sitting still and controlling the aeroplane, but any action calling for the display of muscular activity proves very exhausting. The brain also is affected and becomes sluggish in action. The obvious method of sustaining the pilot at great height is to furnish him with an auxiliary supply of oxygen. This is supplied to him by a tank of compressed air through a regulating valve and a mask which he wears. The valve is so adjusted that it automatically supplies an amount of oxygen which increases as the surrounding pressure decreases. The height at which oxygen should be used varies with the individual; 16,000 to 17,000 feet is about normal.

The Effects of Cold

The only other discomfort experienced is due to the cold. In the winter, even at very moderate heights, frostbite is not uncommon. It is usually the face which is attacked, owing to exposure. In cold weather the face is not exposed more than can possibly be helped. When prolonged flights at considerable height are indulged in, a complete face-mask is worn. The skin is also protected somewhat by rubbing it thickly with grease.

General coldness can only be guarded against by the use of suitable clothing. Electrically heated clothing has been manufactured for use at very high altitudes, but this is seldom necessary. Aerial clothing generally must be designed to be both heat-retaining and wind proof. As combining these two qualities, leather is the most suitable material. The ideal is a close-fitting one-piece garment. It should have no loose parts to blow about and should allow the maximum freedom of movement. The outer layer should be durable and windproof and the inner layer or layers should consist of thick material designed solely to retain the heat of the body. The position of the pockets is a matter of some importance. The pilot's seat, although comfortable, allows little room for movement, therefore the pockets must be so arranged as to be readily accessible without moving from the normal sitting position.

Cold is usually felt most in the hands and in the feet. Experience has shown that the wearing of silk next to the skin is most conducive to the retention of heat in these parts. Wool should be worn over the silk and then the gauntlet or boot. Gauntlets having no separate fingers are most satisfactory. If separate figures are necessary for any reason, a type of gauntlet with a mitt which may be drawn over the fingers at will is most desirable. Boots should be lined with sheepskin throughout and should extend up to the knee.

Scale Models Built by Readers of Aerial Age

A six-foot Curtiss model has been completed by two aeronautic enthusiasts of Marion, Ill.—Messrs. Joe Porter and Ray Horn. The model is built up and covered after the manner of the real plane. Seats and controls are installed. Wheels are 4 inches in diameter. The model can be easily taken apart and packed when desired.

The general dimensions are as follows:

Span (upper wing)	6′ 0″
Span (lower wing)	5′ 9″
Chord (both wings)	10″
Gap (between wings)	11″
Stagger	3″
Overall length	4′ 7″
Overall height	20″

A Curtiss model has been built by another young man from the Middle West—Ray Watkins of N. Park St., Bellefontaine, Ohio. In this instance the design chosen to follow was of a more recent type of Curtiss—the JN4H, the original of which is equipped with a 150 h. p. Hispano engine. The photographs below show the excellent manner in which the model has been executed.

These are the measurements:

Upper wing span	31½″
Lower wing span	24½″
Chord of both wings	4⅛″
Gap between planes	3⅞″
Stagger	¾″
Overall length	21¼″
Dihedral	3°

Fuselage

The fuselage is made of balsa wood, ⅛ inch square. Cowls are of 34 gage aluminum, painted olive drab.

Cockpits and seats are padded with leather. Wind-shields, of celluloid, are fastened to the cowls by fine wire. The rear cockpit is fitted with an imitation instrument board and a control stick which operates the ailerons and elevators, as well as a rudder bar which is in connection with the rudder.

The dummy engine is of wood, painted. The radiator is also of wood, painted so that its front face has the appearance of the cores on a real radiator.

Wings

Balsa wood is used for the wing construction. Front and rear spars are of I section. Leading and trailing edges are of 1/16-inch wire. The top wing panels have 20 ribs and the lower wings 14. There are 32 snap-fasteners used in connection with the streamlined struts, wing skids and overhang or cabane struts.

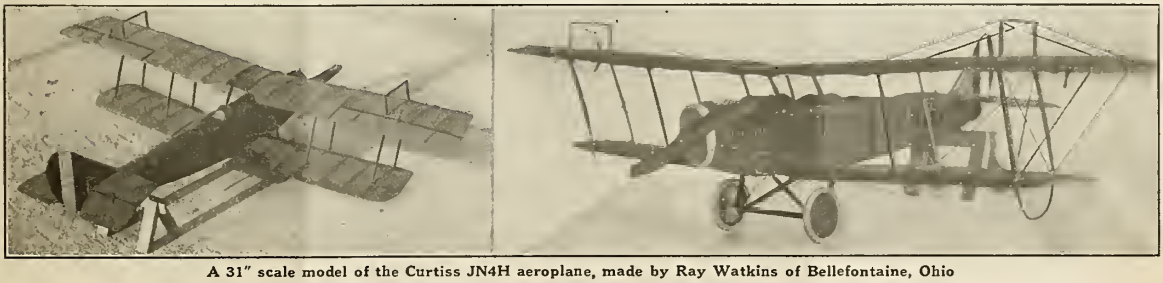
Ailerons are connected to the top plane by two aluminum hinges.

Tail

Five ribs, 1/16-inch thick, are used in the stabilizer. The elevators are fastened in the same manner as the ailerons.

General

Two 2-inch wheels are used on the landing gear. The propeller is carved from a 7-inch spruce block. Linen covering is used, coated, as in the large aeroplanes, with Valspar varnish.



A 31″ scale model of the Curtiss JN4H aeroplane, made by Ray Watkins of Bellefontaine, Ohio

A-E-R-O-N-I-T-I-S

The Last Flight

Where he got that wornout crate,
  God only knows;
How he defied stern fate,
  God only knows;
Where he got that winning smile,
  That cherubic repose,
On a face so free of guile,
  God only knows.

Tho his ship was a hopeless wreck
  It didn't bother Jim,
And lacking of laws to protect
  We could only jeer at him.
He spun and looped and rolled;
  After all, his life was his own,
And the Lord protects the innocent
  So he went to his death alone.

As he spun down a thousand feet
  His ship half split asunder,
We who knew him best of all,
  Came at last to wonder;
Did he go to his death with a smile?
  Did he utter a single groan?
Did he ask "Is the game worth while?"
  As he spun to his death alone.

For deep in our hearts we know,
  'Twas all for love of the game;
And that, many of us will go
  A-spinning down the same;
And many of us again,
  On the trail with "Sunny Jim,"
Will jeer at his wornout plane,
  On the "last flight," with him.

Lt. Art Peirce.

The Rookey

Lord Babbington was instructing the new colored servant in his duties, adding, "Now, Zeke, when I ring for you you must answer me by saying, 'My Lord, what will you have'?"

A few hours afterward, having occasion to summon the servant, his lordship was astonished with the following:

"My Gawd, what does you want now?"—Wayside Tales.

Gentle Hint

He: "I trust I am not tiring you with my presence?"
She (sweetly): "What presents?"

God made man
  Frail as a bubble;
God made love,
  Love made trouble;
God made the vine,
  Was it a sin
That man made wine
  To drown trouble in?

—Idaho Yarn.

MacNally: "I sent a dollar to the fellow who advertised to tell how to take out wrinkles in the face."

Fahey: "And did he tell you?"

Mac: "He did. He said walk out in the open air at least once a day, and the wrinkles would go out with me."

Do You Know That—

A red nose is no longer a sign of drink. He may have a girl who uses rouge.

The only thing harder than living within an income is living without one.

Discharging duty doesn't make much racket.

One should not coax a girl when she tells you that she can't sing, but should let it go at that.

Women who smoke didn't learn it from a kitchen stove.

Grass widows are not green.

A husband should never tell his wife that she will never be the cook his mother was unless he is hunting for trouble.

Some people think that the only way to preserve their youth is to keep it pickled in alcohol.

Clothes may make a man, but a suit of working clothes won't make a bum work.

One must sing a song of more than sixpence to get a pocket full of rye nowadays.

Some men lose their best friend by marrying her.

—P. H. A. C. Weekly.

The Blue Sky Trail

There's a golden trail to the setting sun, along the azure sky,
Where endless miles of fleecy clouds go gently sailing by,
While sunbeams paint in crimson hue, each grotesque shape and form,
And rainbows blend into the midst, false harbingers of storm.

There's a race of men who laughing go along the danger trail,
Who navigate the upper air, as the sea is done by sail.
Who battle its tumultuous storms and win through fog and snow,
Piloting their tiny craft where the trails of man may go.

When evening shadows overspread and the twinkling stars unveil,
A few of these will venture forth who love the Blue Sky Trail,
The Glory Trail that I shall travel, 'till the wings drop off the plane,
'Till the hinges creak and buckle, and I work the stick in vain.

When I drop in a yellow flare, a streak in the noon day sky,
Pray shed no tear in mourning, and heave no bitter sigh,
Just gather up whatever remains, ashes of limbs, or body or brains,
And take me aloft on the golden trail, where the God of sunset reigns.

When the clouds have a crimson hue and night is beginning to lower,
Drive me through the gateway, on the Blue Sky Trail, once more,
Then sprinkle me over the Western Front, the hallowed fields of fame,
Turn me loose, on the Blue Sky Trail, and tell them I "died game."

Lieut. Art. Peirce.

The Airplanes of Yesterday

We made 'em of tin, of pine and bamboo,
We tied 'em with string, we stuck 'em with glue,
We hammered 'em out in various ways,
We patched 'em together with strings and stays.

Where knowledge is guess work, guesses must serve,
And we knew that to fly, the wings must curve,
So we turned out the curves as we turned out the rest,
Products of chance, performance unguessed.

We made our designs with chart and stencil,
With foot rule, paper and bits of lead pencil;
We turned out the camber and angles at will,
And we knew that the factor of safety was nil.

But for all the defects of those wicked old hacks,
We flew and survived the inevitable cracks,
And those who performed on these ships of the past,
Have gone to their rest, all famous at last.

And for all the tacks, the strings and the glue,
They answered our purpose, the old crates flew,
They answered our purpose, and more can we say,
They made the game what it is to-day.

As we ride the new ships constructed to please,
And lounge in upholstery in safety and ease,
Let us pause for a moment and toast while we may,
Those flimsy, rickety crates, the ships of yesterday.

Lieut. Art. Peirce.

(*Concluded from page* 500)

ceived from Mr. Wright thanking the club for their letter and the greetings.

It is greatly to be regretted that throughout the United States it is doubtful if there is a single memorial to commemorate the deed accomplished by those two fearless pioneers of aviation: the Wright brothers. It has remained for those of foreign lands to honor them and recall their achievements.

At Le Mans, France, stands a beautiful sculpture, symbolic of human flight, erected to the memory of the Wrights and the demonstrations given of the aeroplane there in 1908 by Wilbur Wright. Each year the Royal Aero Club of Great Britain honors the memory of the brother who is gone by holding a memorial known as "The Wilbur Wright Memorial Lecture." This is one of the club's most important events.

At the January meeting of the club, which will be held at the Engineers' Club, Philadelphia, Jan. 21st, Mr. Steinmetz will appoint the following committees for the ensuing year. The first named member to act as chairman. House committee: Messrs. Bamberger, Spence and Truscott. Grounds committee: Messrs. Ireland, Hower, Kellett and Hall. Library committee: Messrs. Steinmetz, Gassner, Clarke, Leahy and Sheahan. Reception committee: Messrs. Steinmetz, Gassner and Huyette. Contest committee: Messrs. Hower, Ireland, Kellett, Leahy, Spence, Truscott and Miller. Program committee: Messrs. Steinmetz, Hower and Sheahan. Technical committee: Messrs: Clarke, Armstrong, Brownback, Philips, Bliss and Miller. Balloon committee: Messrs. Eldridge, Gassner and Wynne. Auditing committee: Bamberger and Spence. The following special committees will also be appointed with the first named member to act as chairman. Aviation meets: Messrs. Ireland, Hower, Kellett and Hall. Models and Boy Scout work: Messrs. Owens, Conrow and Pratt. Military aviation: Commander Richardson, Commander Westervelt and Captain Willoughby. Press: Messrs. Gassner, Bamberger, Steinmetz and Sheahan. Membership; Messrs. Spence, Ireland and Hower. Official Photographer, Sheahan. Flight Observers (appointed by the Aero Club of America). Messrs, Steinmetz, Sheahan and Wynne.

As this is to be a year of great activity by the Club, other committees and additional members will be appointed.

Congradulation and the pledged support of the Club have been sent to Hon. George Wharton Pepper, the newly appointed Senator from Pennsylvania. In the communication from the President of the Club, Mr. Steinmetz, he states: "In matters relating to air mails and aeronautic developments as well as the establishment of landing fields for the Great Centennial of 1926 you have the entire support of the Aero Club of Pennsylvania, who will be glad to work with you in any capacity you might suggest."

On Tuesday evening, February 21st, the members of the Club will have a joint meeting with the Engineers' Club, being invited to attend a lecture by Mr. Arthur Halsted, a pilot in the Army aeronautical forces during the Great War and now a member of the Department of Commerce Staff. Mr. Halsted will give a serious and interesting talk on matters connected with aviation and with special reference to accident features and their correction. The services of Mr. Halsted were secured through the courtesy of Mr. M. G. Lloyd, Secretary of Sectional Committee for Aeronautical Safety Code, Department of Commerce, Bureau of Standards, Washington, D. C.

W. H. Sheahan,
1st Vice-President.

(*Concluded from page* 494)

mined. Possibly claims on one accident are limited to the value of the machine to which it happened, as under Admiralty Law (which presumably already applies to seaplanes); possibly they are not. The operators of aircraft can only print a strong cover against liability on their tickets, or perhaps incorporate each plane as a separate company, and find comfort in the safety statistics. It is to be noted that the latter have already led the English insurance companies to strike the clause refusing flying risks from the ordinary life policies.

With the development of the air lines, the insurance rates will undoubtedly always serve as an excellent index on the effectiveness of whatever legislation or regulation there may be and of the soundness of air transportation as a public service and a business.

A Few General Conclusions

In reviewing the possibilities of an early and successful development of air lines in this country it is imperative that the European pioneering in this sort of traffic be closely watched and that the greatest possible use be made of the experience and statistics it has provided. Except as regards purely technical matters, however, these should be applied to American projects and prospects with great circumspection and the difference in political and economic conditions be kept clearly in view. The case of direct government subsidies is a striking one, these having been largely responsible for the development of traffic in Europe, while they are practically unthinkable in this country. What is wanted from the Government here is what may justifiably be looked upon as its natural obligations, that is, the provision of facilities of all kinds, as outlined above. That direct financial assistance ever fosters true progress and new developments no one believes. Human nature being as it is, the tendency is inevitable to regard official aid as manna from Heaven and let things take care of themselves; not to speak of the countless opportunities for favoritism, intrigue and worse, that it entails. Abroad, conditions are different in that respect. It should not be forgotten that most European trunk-lines are international in character and that national pride and political expediency are potent factors in matters of this kind. Also that the various governments have a much greater interest in the maintenance of a commercial air-fleet as well as a ground organization that can be requisitioned at short notice in case of need, than will ever be the case in this country.

Apart from their questionable desirability on the grounds touch upon above, direct subsidies should not be *necessary*. The variety of geographical and economic situations which the United States offers within its own boundaries will provide plenty of scope for financially successful commercial flying operations, if properly taken in hand with proper equipment. The moment that air transportation shows its inherent advantages to the business men of America they will use them on a scale which will leave European traffic figures far behind from the very start. The history of the automobile is a good example.

The amount of traffic, both in passengers and express matter from which the airplanes will be able to draw their share, is great. The "magnificent distances" to which President Harding alluded in his recent message on this subject automatically insure the saving in time that makes air travel pay.

But the first steps are always the hardest and official support in some practical form for operators and builders of commercial aircraft would do much to ease the situation. Contracts for the carriage of mail at rates, commensurate with the increased rapidity of delivery, could be given to reputable air transport concerns whose facilities for carrying out their engagements would bear investigation. Congress can make this possible as it did when mail coach and couriers were replaced by the railroad.

Another valuable form of subsidy would be the development of all purely war-types of machines in the shops of commercial builders and a system of awarding to designing firms paying production contracts for their own original products. Thereby would the aeronautical industry regain a good deal of the confidence which apparently it has lost. And the blending of the newest ideas in aeronautical warfare or defense with the most modern developments in efficiency and reliability would go a long way, in the writer's opinion, toward the reestablishment in this country of supremacy in the air.

Table 1—Official Statistics on the Airlines Between London and the Continent

From January 1, 1921 to October 30, 1921. Approximate total mileage flown, 700,000 miles. Not a single passenger killed or injured.

ROUTE	Distance in Miles	Number of Journeys	Passengers Carried	Journeys Carrying Mail	Journeys Carrying Freight	Journeys Completed to Schedule	Percentage of Journeys Completed	Type of Machines
Paris-London	240	1141	4581	435	787	1021	90	De Havilland Handley-Page Préguet
London-Paris	240	1110	4521	317	407	1033	93	Farman S. P. A. D.
London-Brussels[1]	210	260	298	148	153	243	93.5	Vickers Farman De Havilland
Brussels-London[1]	210	226	353	177	173	201	89	
London-Amsterdam[2]	265	176	200	160	166	167	95	Fokker F-3
Amsterdam-London[2]	265	175	275	164	147	162	93	
Total	...	3088	10228	1401	1830	2827	91.5	

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[1] Service suspended owing to fire at Brussels aerodrome Sept. 28, 1921.

[2] Commenced operations April 14, 1921.

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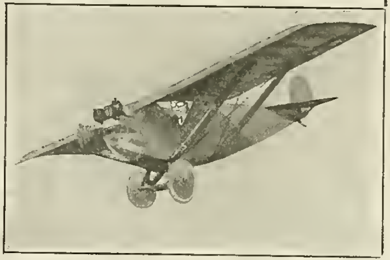

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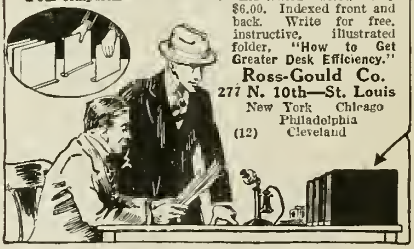

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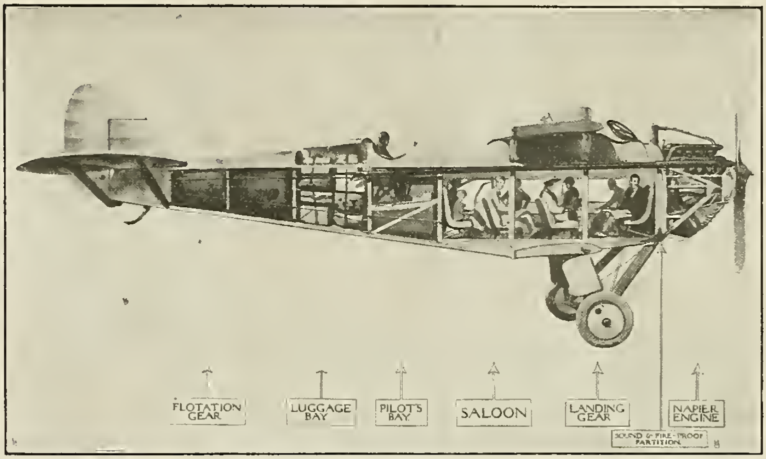

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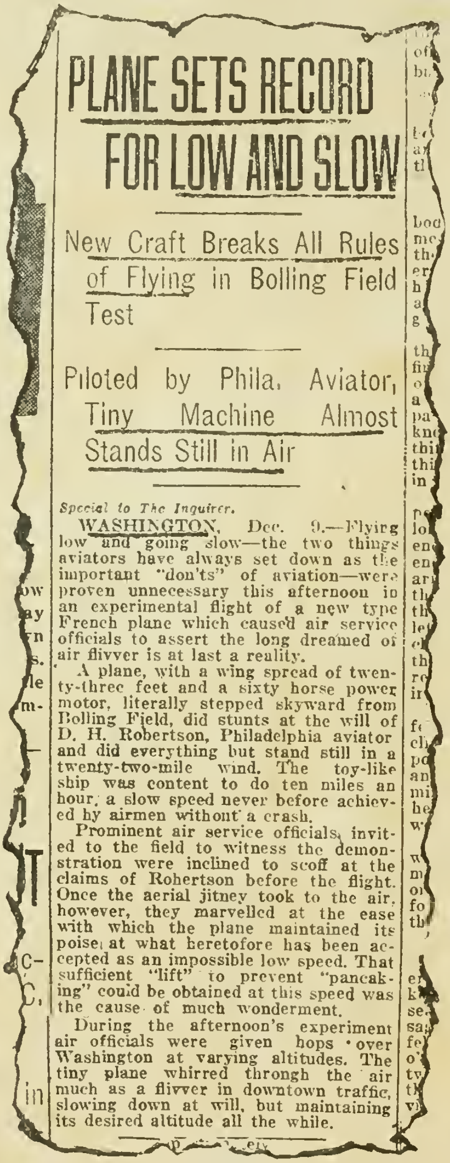

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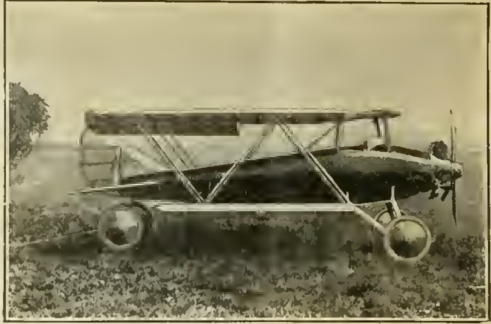

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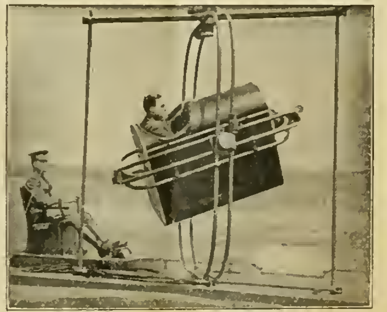

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AERONAUTIC BOOKS

Test Methods for Mechanical Fabrics

By George B. Haven, Associate Professor of Mechanical Engineering, Massachusetts Institute of Technology. Contents.—Aerodynamics. Wind Tunnels. Wings. Resistance. Estimation of Performance. Stress Analysis (by Prof. Howard B Luther, of Massachusetts Institute of Technology). Weight Estimation. Airscrews. Motors. Materials of Construction. [Wiley.]

Principles of Airplane Design

By George Marshall Denkinger, Research Aeronautical Engineer, Air Service, U. S. A., and Clarence Dean Hanscom, formerly Research Aeronautical Engineer, Air Service, U. S. A. (In preparation. Ready Spring, 1921.) Vol. I. Theoretical and Experimental Aerodynamics. Contents.—Aerodynamics. Wind Tunnels. Wings. Resistance. Vol. II. Applied Aerodynamics. Contents.—Estimation of Performance. Stress Analysis. Weight Estimation. Air Screws. Motors. Materials of Construction. [Wiley.]

Aeronautics—A Class Text

By Edwin Bidwell Wilson, Ph.D., Professor of Mathematical Physics in the Massachusetts Institute of Technology. 265 pages. 6 by 9. 31 figures. Cloth. Postpaid $4.25.

Covers those portions of dynamics, both rigid and fluid, which are fundamental in aeronautical engineering. It presupposes some knowledge of calculus. The book will prove stimulating to other than technical students of aeronautical engineering. Contents.—Introduction. Mathematical Preliminaries. The Pressure On a Plane. The Skeleton Airplane. Rigid Mechanics. Motion in a Resisting Medium. Harmonic Motion. Motion in Two Dimensions. Motion in Three Dimensions. Stability of the Airplane. Fluid Mechanics. Motion Along a Tube. Planar Motion. Theory of Dimensions. Forces On An Airplane. Stream Function, Velocity Potential. Motion of a Body in a Liquid. Motion in Three Dimensions. Index. [Wiley.]

The Dynamics of the Airplane

By K. P. Williams, Ph.D., Associate Professor of Mathematics, Indiana University. (No. 21 of Mathematical Monographs, Edited by Mansfield Merriman and Robert S. Woodward.) 138 pages. 6 by 9. 50 figures. Cloth. Postpaid $2.75.

An introduction to the dynamical problems connected with the motion of an aeroplane, for the student of mathematics or physics. While not written for the person interested mainly with design and construction, most of the questions treated have some interest for anyone who is familiar with the entire field of aeronautics. The development of the French writers is followed more closely than that of the English and American, the author believing that it is worth while to make a treatment of this general sort accessible to American students of mathematics. Contents.—The Plane and Cambered Surface. Straight Horizontal Flight. Descent and Ascent. Circular Flight: 1. Horizontal Turns. 2. Circular Descent. The Propeller. Performance: 1. Ceiling. 2. Radius of Action. Stability and Controllability: Longitudinal Stability. Stability in Rolling. Lateral Stability. [Wiley.]

Learning to Fly in the U. S. Army

By E. N. Fales. 180 pages. 5 x 7. Illustrated. Postpaid $1.75.

In this book are set forth the main principles of flying which the aviator must know in order properly to understand his aeroplane, to keep it trued up, and to operate it in cross country flight as well as at the flying field. The material presented is all standard information, previously available to students only in fragmentary form, but not up to this time collected and arranged in logical order for study and quick reference. Contents.—I. History of Aviation. II. Types of Military Airplanes and Uses. III. Principles of Flight. IV. Flying the Airplane. V. Cross-Country Flying. VI. The Rigging of Airplanes—Nomenclature. VII. Materials of Construction. VIII. Erecting Airplanes. IX. Truing Up the Fuselage. X. Handling of Airplanes in the Field and At the Bases Previous to and After Flights. XI. Inspection of Airplanes. [McGraw.]

Aircraft Mechanics Handbook

By Fred H. Colvin, Editor of American Machinist. 402 pages. 5 by 7. 193 illustrations. Postpaid $4.25. New Edition.

A book specifically for the aircraft mechanic. During the war it was extensively used as a textbook in the U. S. Navy Training Stations, the Army Flying Fields and Schools of Military Aeronautics. It covers briefly the principles of construction, and gives in detail methods of erecting and adjusting the plane. The book is especially complete on the care and repair of motors. Descriptions of the various types of military aeroplanes and engines are given. The photographs and cuts show the principles and practice of adjustment and operation. [McGraw.]

Airplane Design and Construction

By Ottorino Pomilio. 403 pages. 6 by 9. Illustrated. Postpaid $5.25.

This was the first book to be published in this country which presents in detail the application of aerodynamic research to practical aeroplane design and construction. Although the feat of flying in a heavier than air machine was first accomplished in America, the major part of experimental work in aerodynamics has been conducted in Europe. The Pomilios of Italy have had an important part in this experimental work. The data presented in this book should enable designers and manufacturers to save both time and expense. The arrangement, presentation of subject matter, and explanation of the derivation of working formulae together with the assumptions upon which they are based and consequently their limitations, are such that the book should be indispensable to the practical designer and to the student. [McGraw.]

Radio Engineering Principles

By Henri Lauer, formerly Lieutenant, Signal Corps, U. S. A., Assistant in the Preparation of Training Literature on Radio Theory and Equipment, and Harry L. Brown, formerly Captain, Signal Corps, U. S. A., in charge of the Preparation of the Technical Training Literature used in the Signal Service. 304 pages. 6 by 9. 250 illustrations. Postpaid $3.75.

This is the first book to bring the science of radio up to date—to include the wonderful developments made during the war. In no other book published in this country is there such complete information on vacuum tubes. About one-half of Lauer and Brown's "Radio Engineering Principles" is devoted to the discussion of the three-electrode vacuum tube, taking up its use as detector, amplifier, oscillator and modulator. The book covers thoroughly the operation and characteristics of two- and three-electrode vacuum tubes, the practical applications of the tubes, the generation and control of electron flow, and the conditions which must obtain to cause a tube to operate in any of its functions. Aeroplane and submarine radio theory is discussed in detail. Other special applications of the vacuum tube are also treated. Lauer and Brown's "Radio Engineering Principles" is the authoritative modern textbook on the subject. [McGraw.]

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The Aeroplane Speaks

By H. Barber, A. F. Ae. S. (Captain, Royal Flying Corps). Postpaid $3.25.

Captain Barber, whose experience in designing, building and flying aeroplanes extends over a period of eight years, has written this book to be of assistance to the pilot and his aids. Lucid and well illustrated chapters on flight, stability and control, rigging, propellers and maintenance are followed by a glossary of aeronautical terms and thirty-five plates illustrating the various types of aeroplanes and their development from the first practical flying machine. An introduction presents, in the form of conversations between the various parts of the aeroplane, a simple explanation of the principles of flight, written, says the author, "to help the ordinary man to understand the aeroplane and the joys and troubles of its pilot." [McBride.]

Aeroplane Design

By F. S. Barnwell. With a Simple Explanation of Inherent Stability—By W. H. Sayers With diagrams. Postpaid $1.10.

Mr. Barnwell, who is well known as a highly successful designer, holds a commission in the Royal Flying Corps. The section of this book written by him formed a treatise read before the Engineering Society of Glasgow University. Mr. W. H. Sayers in the second part of the volume elucidates a problem that has been the occasion of much discussion among mathematicians—that of inherent stability. Both sections are fully illustrated by diagrams. This book has been adopted by the U. S. Government as a text book for the instruction of aviators. [McBride.]

Aerobatics

By Horatio Barber, A. F. Ae. S. With 29 half-tone plates showing the principal evolutions. Postpaid $3.50.

This book by Captain Barber, whose earlier work, "The Aeroplane Speaks", is recognized as the standard textbook on ground work and the theory of flight, is an explanation in simple form, and for the benefit of the student, of the general rules governing elementary and advanced flying. Part I, which is headed "Elementary Flying", is an explanation of the essential elements of flight instruction from the moment the student enters the machine until he becomes a finished pilot. The mechanical control of the machine, straight flying, turns of all kinds, stalling, diving, gliding, side-slips, and various ways of landing, flying through clouds, "taxying" and the first solo flight are described and analyzed fully and in non-technical language, each subject being taken up in progressive order. Part II explains the more advanced evolutions such as looping, spinning, the barrel roll, the complete roll, the Immelman turn, the falling leaf, the cart wheel, etc. The book contains a progressive syllabus of instruction, a glossary of technical terms and numerous advisory hints. [McBride.]

Flying Guide and Log Book

By Bruce Eytinge. With a Foreword by H. M. Hickam, Major, Air Service. 1921 edition, enlarged and revised to date. 150 pages. 4¼ by 7¼. 38 illustrations, including many photographs of landing fields, and a 24-page Pilot's Log Book for Machine, Motor and Flying. Cloth. Postpaid $2.75.

This book contains valuable information for the aviator, and also, for all those who are interested in, and helping to develop, commercial aviation. Contents.—Calendar. Identification. Frontispiece. Foreword. Past and Present (Poem). Introduction. Don'ts. Helpful Hints. Landing Field Report (Questionnaire). Airdromes—Landing Fields. War Department Orders: Specifications for Municipal Landing Fields. General Flying Rules to Be Observed At All U. S. Flying Fields. Cross-Country Flight Regulations. Rules of the Air. Flying Certificates for Pilots. Trouble Shooting in Airplane Engines. America's Aviation Facilities—Landing Fields (Alphabetically Listed Under Each State). Trans-Continental Aerial Mail Route. Air Routes (Round the Rim Flight). Pilot's Log Book for Machine, Motor and Flying. [Wiley.]

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